UNIVERSITY OF MICHIGAN NUMBER

Vol. 30 NOVEMBER, 1944 No. 11

American Journal of Orthodontics and Oral Surgery

FOUNDED IN 1915

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Vol. 30, No. 11, November, 1944. American Journal of Orthodontics and Oral Surgery is published Monthly by The C. V. Mosby Company, 3525 Pine Blvd., St. Louis 3, Mo. Subscription Price: United States, Its Possessions, Pan-American Countries, $8.50; Canada, $10.00 (Canadian Currency); Foreign, $9.50. Entered as Second-class Matter at Post Office at St. Louis, Mo., under Act of March 3, 1879. Printed in the U. S. A.

NOVEMBER, 1944

Orthodontics

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Office of the Editor: 8022 Forsythe Boulevard, St. Louis
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American
Journal of Orthodontics
and Oral Surgery

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VOL. 30 NOVEMBER, 1944 NO. 11

Original Articles

STUDIES ON THE RATE AND AMOUNT OF ERUPTION OF CERTAIN HUMAN TEETH*

HARRY CARLSON, D.D.S., M.S., COURTLAND, CALIF.

INTRODUCTION

THE eruption of human teeth has interested investigators from very early times and our knowledge of this process has been advanced in direct proportion to the development of methods for its study. Until cephalometric roentgenology was developed to a stage of scientific accuracy, however, it was not possible to study the complete process of eruption of teeth in the same individual or animal over a period of time. This study represents such an effort. It is restricted to a consideration of the rate, amount, and direction of the eruption of certain teeth, viz., the mandibular central incisor, canine, first and second premolars, and first molar.

REVIEW OF LITERATURE

Methods that have been employed in the study of the rate, amount, and direction of eruption may be considered under the following headings:

1. Clinical.
2. Histologic.
3. Vital Staining.
4. Roentgenologic.

*At the meeting of the American Association of Orthodontists held in New Orleans in 1942, the Board of Directors empowered the Research Committee to conduct an annual prize essay contest. An annual award of $200 was established for this purpose. The terms for the competition were set as follows:

Eligibility. Any student enrolled in a recognized university, or any person who had completed his or her formal education in orthodontics not more than three years prior to Jan. 1, 1944, would be eligible to compete for the prize.

Essay. The essay must represent a piece of original research having a direct bearing on the field of orthodontics. It may relate either to a biologic or clinical problem and may represent material that has been offered in partial fulfillment of the requirements of a graduate or postgraduate degree, or any graduate, postgraduate, or undergraduate contest.

Dr. Harry Carlson completed this piece of research work at the University of Illinois. It met with the requirements of the judges for the prize essay and the award of $200 was presented to him.

Clinical Method.—Clinical observation is of course the oldest method and it is not surprising to find that the order of eruption of teeth through the gum was rather accurately laid out by investigators at an early date. Of more recent years there has been a great deal of work done on large samples of different populations. These have greater scientific value. In this connection Hellman[9] observed and tabulated eruption in 2,250 persons, and Kuttler[13] observed 15,240 children and 782 adults. These findings showed quite definitely that the order and speed of eruption might be affected in malocclusion and by sex, nationality, and economic status. It should be pointed out that all of these studies deal with the eruption of teeth only from the time they pierced the gum.

Histologic Method.—Although a great deal of work has been carried on by histologic methods, most of the studies have been of a qualitative nature, i.e., they sought to determine the processes through which teeth came to erupt. There are several exceptions to this, however. Orban[16] made a series of measurements from the floor of the nose to the deepest point of the tooth germ and called it *a*; the length of the tooth germ was called *b*, while *c* was the distance from the tooth germ to the mouth epithelium. These measurements were made on the germs of the deciduous teeth of different embryos. It was found that the distance *a* increased slightly during development, being less in the smaller embryos and greater in the larger. The greatest increase took place in *b* and *c*. From this Orban reasoned that Hertwig's epithelial sheath, or the deepest point of the tooth germ, remained at a fairly constant position while the growth of the tooth germ took place.

Gottlieb,[7] using ankylosed teeth as fixed points for measurement, studied the rate and amount of eruption. He concluded that Hertwig's epithelial sheath could not be a fixed point because permanent teeth continued to erupt long after they came into functional opposition to their antagonists. Another observation made by Gottlieb has been stressed by Weinmann.[17] This is that the position of the horizontally placed bony trabeculae under the tooth germ varies at different periods of eruption. If one uses the distance between the tooth and these plates as a criterion, there appears to be a period of slow eruption first, which is followed by a more rapid eruption. This is in turn succeeded by a second period of slow eruption as occlusion is attained.

Vital Staining.—The method of vital staining was first applied to dental tissues by John Hunter.[12] He apparently did not use it for a study of tooth eruption; however, Brash[2] employed the method of madder feeding, similar to that of Hunter and on the same animal, viz., the pig. Both of these investigators were more interested in bone and its growth and neither of them measured rates of eruption.

Hoffman and Schour[11] have measured the rate of eruption of rat molars. They made ingenious use of the vital staining technique by injecting alizarin red S at definite intervals.[10] This gave them a red line at the crest of the alveolar process which represented the height of that process at the time of injection. Using this as a fixed point they measured the distance from this level to the cementoenamel junction. To further control their experiment they subjected their animals to periodic x-ray examination. They concluded that "the rate of eruption of rat molars was greatest prior to the establishment of functional occlusion, and decreased with age;" also, that "the initial appearance of the

tooth in the mouth at about the nineteenth day did not markedly retard the rate at which the tooth was erupting; however, when the tooth came into occlusion an abrupt retardation became apparent."

Roentgenologic Method.—Although the x-ray had been employed to observe the eruption behavior of teeth, it was not until Broadbent[3] introduced roentgenographic cephalometry in 1931 that a technique of sufficient accuracy was available for investigative purposes. With the Broadbent technique it was possible to control accurately the angulation and distortion factors of head x-rays. Broadbent himself has demonstrated very vividly the course of eruption of most of the teeth.[4, 5] For this he has employed an animated moving picture technique which is developed by superpositioning of tracings of successive stages of eruption of the same individual. While this method is the most graphic representation of eruption, it presents such technical difficulties that it is impossible to correct all errors. To avoid "jumpiness" of the picture the successive tracings must be superimposed on cranial landmarks and the enlargement factor must be disregarded as a constant error.

Broadbent has recognized these limitations and has recently published work in which attention is focused more specifically on the teeth themselves and their immediate environment. From these latter studies[8] he has pointed out: First, the growing tooth may remain stationary while its forming root grows from the incisal or occlusal surface into the bone. Second, the tooth may migrate through the bone with little addition to its root length. Third, the root length addition and the migration of the tooth may occur simultaneously. He has not published any quantitative data on rates, however.

In order to eliminate the error of enlargement and thus make x-ray cephalometry available for strictly quantitative work, it is necessary either to apply a correction formula to each measurement taken or to employ special scales for this purpose. Such correctional scales have been developed in the Department of Orthodontia, University of Illinois, by Adams,[1] and their accuracy has been demonstrated by Brodie[6] in numerous growth studies.

MATERIAL AND METHOD

The material used in the present study consisted of five series of cephalometric lateral and frontal x-rays. These were derived partly from the files of the Bolton Study, Western Reserve University, and partly from the files of the Department of Orthodontia, University of Illinois. Each series consisted of a group of cephalometric roentgenograms of a single child, taken at six-month intervals over a period of ten years. The ages of the children overlapped so that the study covers the range of 3 months to 17 years of life (Fig. 1). All five children had normal occlusion of the teeth.

After orienting the frontal and lateral headplates on a transilluminated drafting table, complete tracings were made of both. All measurements were made from the tracings. Using a tangent to the inferior border of the mandible as a base line, corrected measurements were made to the lowest point of the root end, to the highest point of the crown, and to the occlusal plane directly over the tooth. In addition to the distortion introduced by enlargement it was found necessary also to correct for foreshortening, which occurs whenever a tooth is

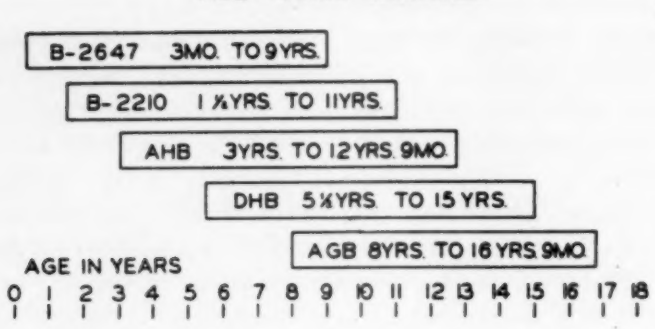
AGE RANGE MEASURED
B-2647 3MO. TO 9YRS.
B-2210 1 ½YRS. TO 11YRS.
AHB 3YRS. TO 12YRS. 9MO.
DHB 5 ½YRS. TO 15 YRS.
AGB 8YRS. TO 16 YRS. 9MO.
AGE IN YEARS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Fig. 1.

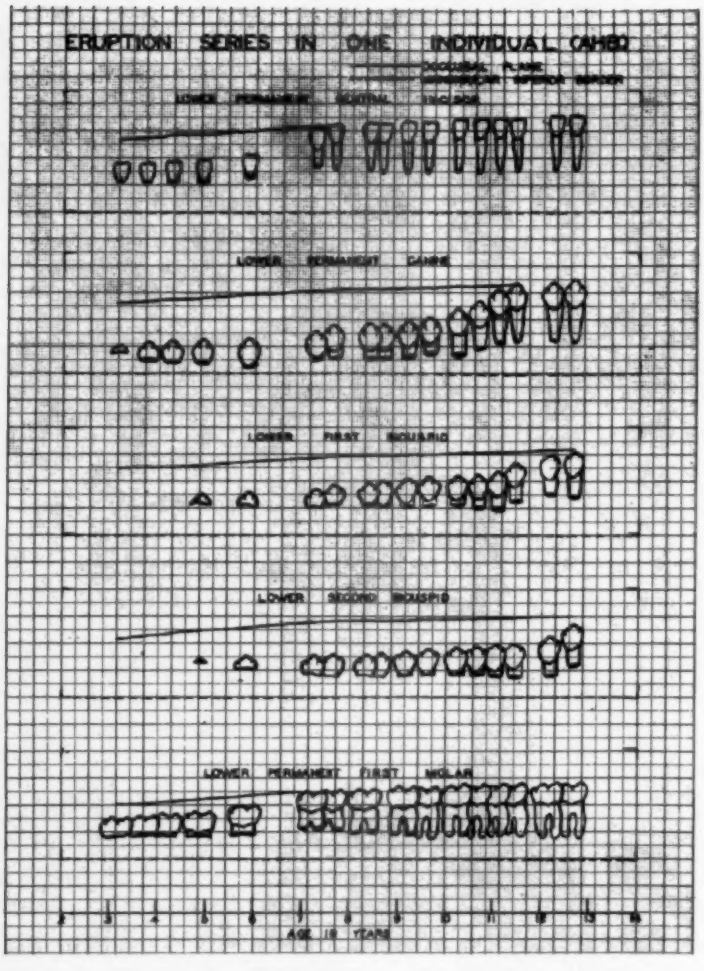
ERUPTION SERIES IN ONE INDIVIDUAL (AHB)
LOWER PERMANENT CANINE
LOWER FIRST BICUSPID
LOWER SECOND BICUSPID
LOWER PERMANENT FIRST MOLAR
AGE IN YEARS

Fig. 2.

tilted toward or away from the film. This correction is possible by projection from the frontal film, which is taken at a right angle to the lateral.

The propriety of using the mandibular inferior border as a line from which to make measurements is based on the findings obtained with vital staining methods on pigs by Brash[2] and similar work on macaque monkeys by Massler.[14, 15] He found that for approximately a year before the eruption of the permanent first molar, deposition of bone on the inferior border of the mandible was negligible.

Fig. 2 represents the study of the eruption of five teeth in one individual and indicates how the measurements were made. All measurements were tabulated (Tables I to V) and line graphs were constructed (Figs. 3 to 7).

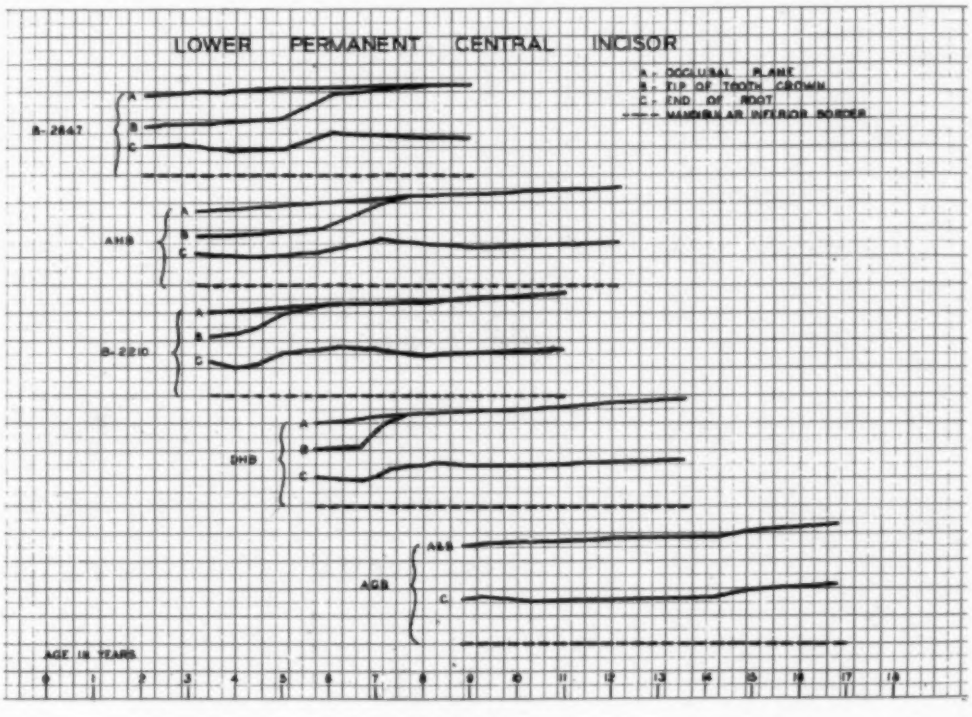

Fig. 3.

FINDINGS

1. Without exception, the teeth studied showed a constant increase in the distance between the tip of the crown and the lower border of the mandible, regardless of age.

2. During the period of crown formation of some teeth, notably the lower canine, there was a constant decrease in the distance between the lower border of the mandible and the open or forming end of the crown. In others, the open end maintained approximately the same distance between these two points.

3. Coincident with the beginning of root formation the distance between root end and mandibular border invariably decreased. Since the crown tip continued to move occlusally, this could be interpreted only as an actual downward growth of root into the subjacent bone. The amount of this downward growth was found to be 2 to 4 mm.

TABLE I

CASE B 2647

AGE		0-3-0	0-5-30	0-9-0	0-11-22	1-6-5	2-0-26	2-6-2	2-11-26	3-6-8	3-11-24	4-6-2	5-0-2	6-0-28	6-11-18	7-11-17	8-11-20
PLATE NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Central	a*						11	11	11	10	9.5	10	10	16	15	14.5	14
	b†						18	18.5	18.8	19.2	19.5	20.5	21	29.5	31	32	33
	c‡						29	29.1	30	30.2	30.5	31.5	31.8	32	32.5	32.7	33
Canine	a						9	8	7.5	6	5.5	5	4	3.5	4	7	10.5
	b						12	12.2	12.7	12.8	13	13.5	14	15	16.5	20	27.5
	c						26.5	27.5	28	28.3	28.5	29	29.5	29.6	30.5	31	31.5
First Premolar	a									10	10	10	10	9	9.5	11	11
	b									12	13	15	16	16.5	19	21	23
	c									27	27.5	28	28.3	29	29.5	30	30.3
Second Premolar	a										12.5	11	7	7	7.7	8.5	9
	b										14	14.5	15	16	17	18	20
	c										25	26	27	27.3	27.5	28	28.5
Molar	a	8	8	7.5	7	8	9	9	9	9	10	9	9	10	8.5	8.5	8.5
	b	8.5	9	10	11	13	14.5	15	15.5	16	17.5	18	20	23	24	25	26.5
	c						17.5	18.5	19	20	22.5	23.7	23.8	23.9	24	25	26.5

*a, Inferior border to root end.
†b, Inferior border to tooth cusp tip.
‡c, Inferior border to occlusal plane.

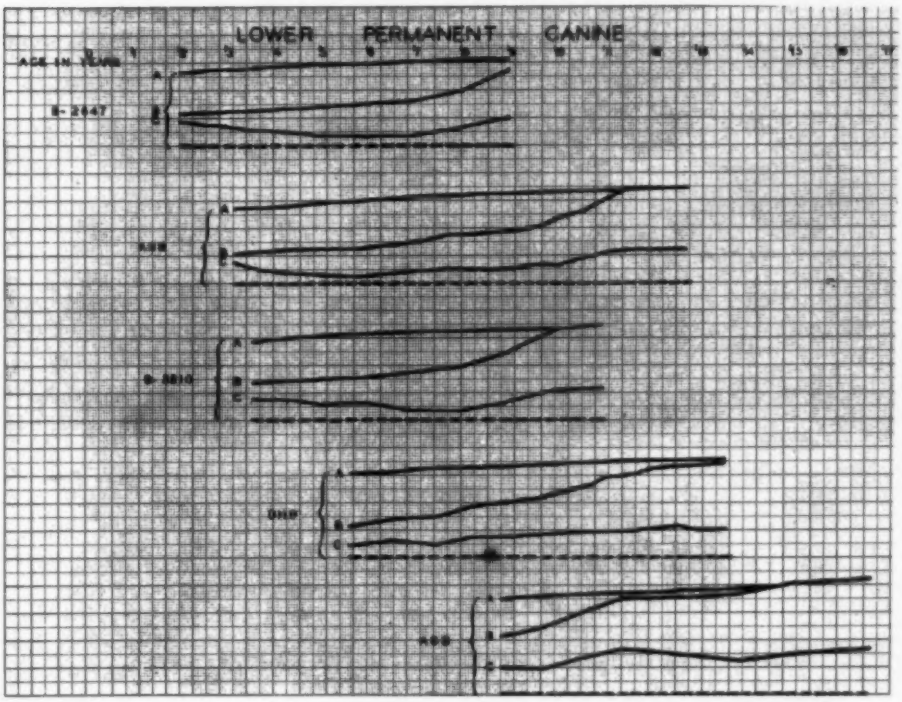
LOWER PERMANENT CANINE
AGE IN YEARS
A
B
C

Fig. 4.

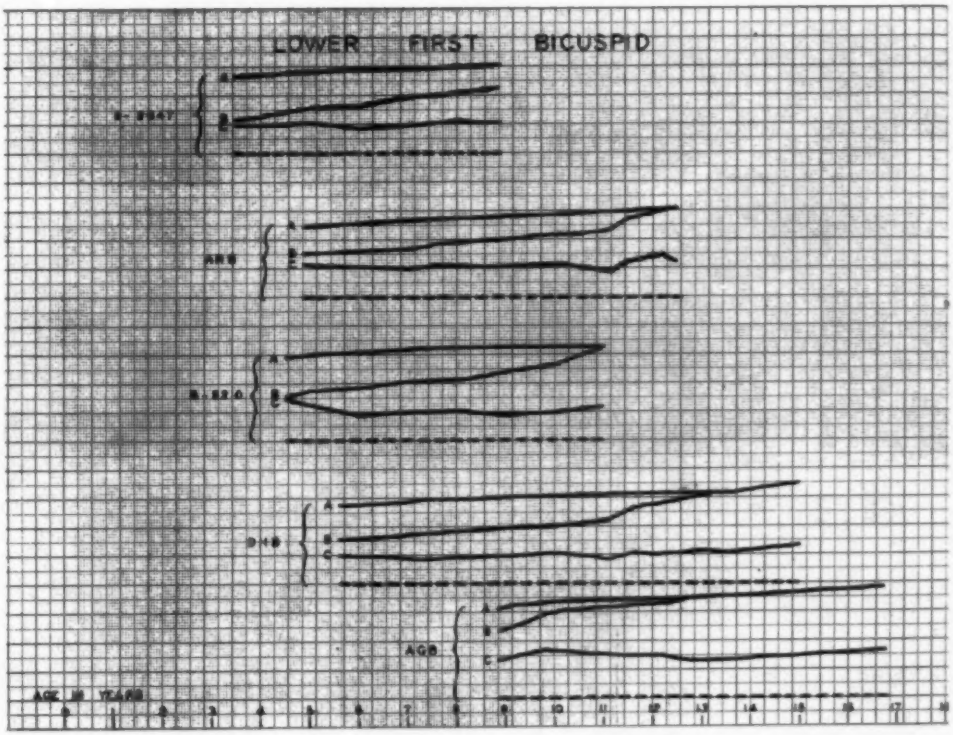
LOWER FIRST BICUSPID
A
B
C
AGE IN YEARS

Fig. 5.

TABLE II

BOLTON CASE 2210

AGE		1-6-0	2-0-2	3-5-26	4-0-2	4-5-24	4-11-30	6-0-5	7-0-6	8-0-28	9-0-3	10-0-3	11-0-1
PLATE NO.		1	2	3	4	5	6	7	8	9	10	11	12
Central	a*			12.5	11	12	16	18	17.5	15	16	16.5	17
	b†			22	23	25	30	33	33.5	34	35.5	36	37.5
	c‡			30	31	31.5	32.5	33.5	33.8	34	35.5	36	37.5
Canine	a			8	8	7	6	6.5	4	4	7	11.5	12
	b			14	14.5	15	15.5	16	18	20	25	34	34.5
	c			29	30	30.5	31.5	32	32.5	33	33.2	34	34.5
First Premolar	a					14.5	13	9	10	10	9	10	12
	b					16	17	18.5	21	21.5	24	26.5	32.5
	c					29	30	31	32	32.5	32.7	32.8	33
Second Premolar	a				13	10	10	10.5	9	7.5	7.5	13.5	12
	b				14	15	16	17	17.5	18	20	27	31
	c				26	26.5	27	27.5	29	30	30.3	30.7	31
Molar	a			8.5	11	8	10	10	9	9	8	8	8
	b			15	17.5	20	22.5	24	25	26	26.2	26.8	27.5
	c			22.5	23	23.5	24	24.5	25	26	26.2	26.8	27.5

*a, Inferior border to root end.
†b, Inferior border to tooth cusp tip.
‡c, Inferior border to occlusal plane.

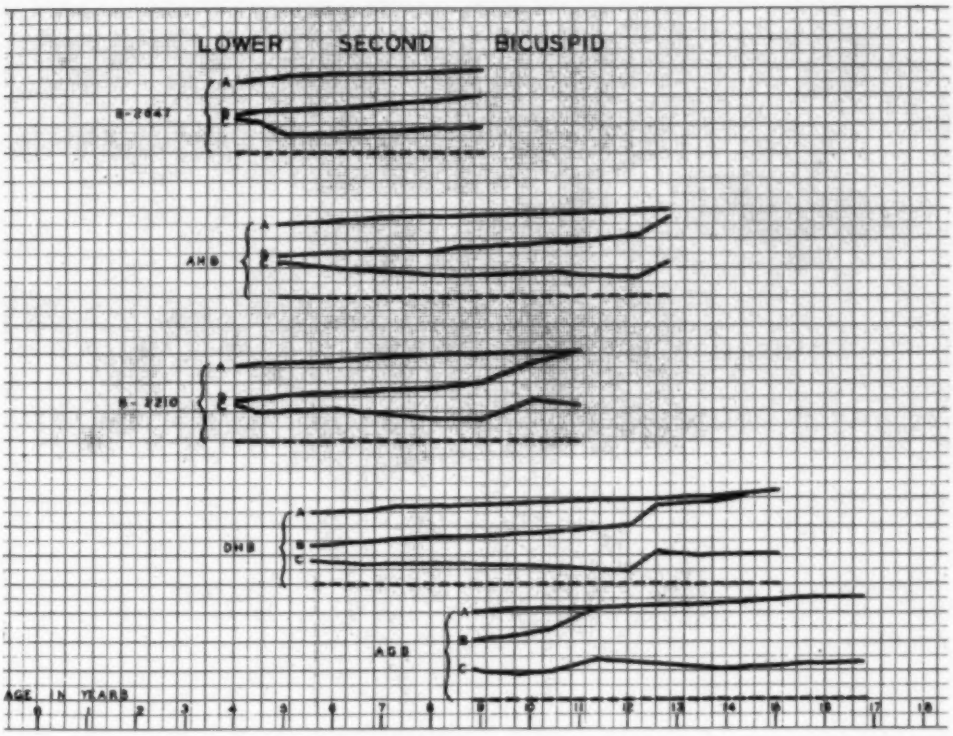
LOWER SECOND BICUSPID
B-2647
A
B
AHB
B-2210
DHB
C
AGB
AGE IN YEARS

Fig. 6.

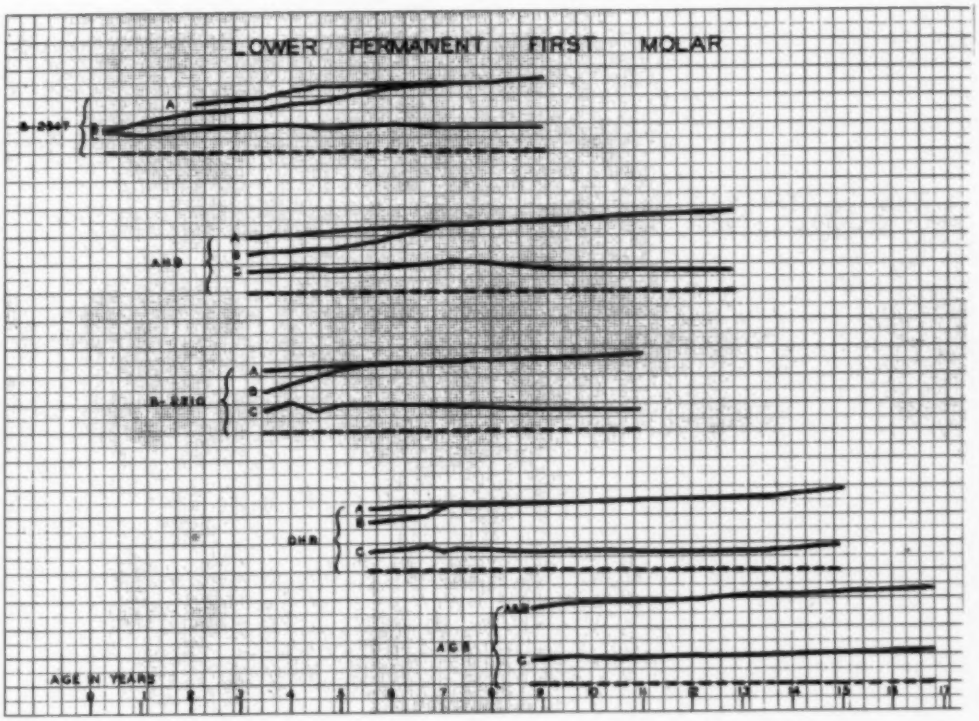
LOWER PERMANENT FIRST MOLAR
B-2647
A
AHB
B-2210
DHB
AGB
AGE IN YEARS

Fig. 7.

TABLE III

CASE A. H. B.

AGE		3-1-24	3-8-15	4-3-4	4-10-6	5-10-0	6-7-18	7-1-29	7-7-4	8-4-2	8-7-22	9-2-15	9-7-15	10-1-26	10-7-2	11-1-24	11-5-16	12-2-0	12-9-0
PLATE NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Central	a*	11.5	11.0	10.8	10.8	12.8		17	16	15	14.5	14	14	14.5	14.7	15	15.2	15.5	15.7
	b†	18	18.3	18.8	19	21		30.5	32	33	33.3	33.5	34	34.5	34.7	35	35.3	35.5	35.7
	c‡	27	27.5	28.2	28.8	30		31.4	32	32.4	32.6	33.5	34	34.5	34.7	35	35.3	35.5	35.7
Canine	a	7.5	5	4	3.5	3		5	5.5	5.2	5	6	7.3	6.5	9	11.5	12	12	12
	b	11	12	12.3	12.5	13		15.5	18	18.3	18.5	19.5	21	24	27	31.5	33.5	34	34.2
	c	27.3	27.8	28.5	29.3	30.3		32	32.3	32.5	32.7	33	33.3	33.5	33.7	33.9	34	34.3	34.5
First Premolar	a				11	10.5		10	11	10.5	10.5	11	11	11	9.5	9	12	14.7	12.5
	b				15	16		17	18.5	19	20	20.5	21.5	22	22.3	23.5	27	30	31
	c	24.5	25	25.5	26	27		28.5	29	29.2	29.5	29.7	29.9	30	30.8	31	31.2	31.6	31.8
Second Premolar	a				13	10.5		8.7	8	8	8	8	8.3	8.5	8.5	8	7.6	7.4	12
	b				14.5	15.5		15.7	16	17	17.2	17.5	18	18.5	19	19.7	20	21.5	27.5
	c	22	23	24	25	26		27.5	28	28.2	28.4	28.6	28.8	29	29.2	29.4	29.8	30	30.5
Molar	a	8.5	11	10	9	9.5		9.5	11	9.5	9	9	8	7	7	9	8	8.5	9
	b	15	16.5	17	17.5	19.5		25	25.5	26	26.1	26.2	26.3	26.4	26.5	26.7	26.8	26.9	27
	c	20	20.5	21	22	23		24.7	25.5	26	26.1	26.2	26.3	26.4	26.5	26.7	26.8	26.9	27

*a, Inferior border to root end.
†b, Inferior border to tooth cusp tip.
‡c, Inferior border to occlusal plane.

TABLE IV

CASE D. H. B.

AGE		5-7-2	6-8-12	7-0-23	7-3-14	8-3-8	9-0-26	9-7-7	10-0-12	10-9-10	11-1-1	11-7-25	12-0-24	12-7-4	13-0-10	13-7-2	15-0-21
PLATE NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Central	a*	10.5	10	12	14	16	15.5	15	15	15.5	15.5	16	16.3	16.6	16.5	16.7	17
	b†	21	22.5	29	31	34	34.5	35	35.3	36	36.3	37	37.5	38	38.5	39	39.5
	c‡	31	32	32.5	33	34	34.5	35	35.3	36	36.3	37	37.5	38	38.5	39	39.5
Cuspid	a	5	6.5	5.5	5	7.5	8	8.5	9	9.5	9.5	10	11	10.5	10.5	11	12.5
	b	12	14.5	15	15.5	19	20.5	22	24	27.5	30	31	33	33.5	34	35	38.5
	c	31	31.5	32.5	33	33.3	33.7	34	34.5	35	35.2	35.4	35.6	35.7	35.9	36	38.5
First Premolar	a	9.5	9.5	9	9	9.5	9.5	10	10.5	9.5	8.5	11	10	11.5	11.5	11	13.5
	b	16	17	17.5	18	19	19.5	20.5	21.5	22	22.5	27	28	30	31	31.5	35
	c	28	28.4	28.7	29.5	30	30.3	30.7	31.2	31.4	31.5	31.6	31.7	31.8	31.9	32	35
Second Premolar	a	8	7	7	7	7	7	6.5	6.5	6.3	5.5	5	5	11.5	10.5	10	11
	b	13.5	15	15.5	16	16.5	17	17.5	18	18.5	10	20	20.5	28	28.5	29	33
	c	25.5	26	26.5	27.5	27.8	28	28.3	28.5	29	29.2	29.4	29.6	29.7	30	30.5	33
Molar	a	7	9	8	8.5	7.5	7	7	7.2	7.5	7	7	7.5	7	7	7	9
	b	18	20	23	24	24.2	24.3	24.7	25	25.2	25.4	25.5	25.9	26	26.3	26.5	29
	c	22.5	23.5	24	24.1	24.2	24.3	24.7	25	25.2	25.4	25.5	25.9	26	26.3	26.5	29

*a, Inferior border to root end.
†b, Inferior border to tooth cusp tip.
‡c, Inferior border to occlusal plane.

TABLE V

CASE A. G. B.

AGE		8-10-1	9-2-18	9-10-7	10-5-9	11-5-3	12-2-21	12-9-2	13-2-8	13-11-5	14-2-26	14-9-17	15-2-18	16-2-5	16-8-27
PLATE NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Central	a*	17	17.5	17	16.5	16.5	17	17.2		17.4	17.5	19.5	20.5	21.1	22
	b†	36	37	37.5	37.7	38	38.5	38.7		38.9	39	41	42	42.5	43.5
	c‡	36	37	37.5	37.7	38	38.5	38.7		38.9	39	41	42	42.5	43.5
Cuspid	a	10	9.5	10	13	17	16.2	15		13	13.5	14	15.5	16.5	17
	b	22	22.5	22.5	29	35.5	35.7	36		37	39	39.5	41	42	42.5
	c	35.5	36	36.5	37	37.3	37.7	38.5		38.8	39	39.5	41	42	42.5
First Premolar	a	13.5	14.5	16.5	16	15	15	13.5		14.7	14	14.5	15.5	16	16.5
	b	23.5	25	29.5	31	32	33	34.5		35.7	36	36.5	37.5	38	38.5
	c	31.5	32.5	33.5	34	34.2	34.4	34.5		35.7	36	36.5	37.5	38	38.5
Second Premolar	a	10	9	9	10	13.5	12.5	12		10.5	11	11.5	12	12.5	13
	b	21	21.5	22.5	25	32	32.5	33		33.5	34	34.5	35	35.5	36
	c	30	31	31.5	31.7	32	32.5	33		33.5	34	34.5	35	35.5	36
Molar	a	9	9.5	10	9	9.5	10	10		10.2	10.4	11.2	11.5	11.8	12
	b	27	28	29	29	29	30.3	31.5		31.7	31.9	32.7	33	33.3	33.5
	c	27	28	29	29.1	29.2	30.3	31.5		31.7	31.9	32.7	33	33.5	33.5

*a, Inferior border to root end.
†b, Inferior border to tooth cusp tip.
‡c, Inferior border to occlusal plane.

4. Following the downward growth of the root there was a period of rapid eruption of the teeth during which all points on the teeth were seen to increase their distances from the mandibular border. Such distances did not increase equally, however. The crown tip showed a greater movement than the root end, indicating that eruption was proceeding more rapidly than was root formation.

5. In most of the teeth the period of rapid eruption continued until the tooth came into occlusion, when there was a sudden slowing down. From this time on the tooth erupted only as rapidly as the occlusal plane arose.

6. Coincident with the attainment of occlusion there was seen a second period during which the root end decreased its distance from the mandibular border. This marked the completion of root formation.

7. Once the root was completed, the entire tooth again moved upward at the same rate as that of the occlusal plane.

8. The rate of eruption was different in different teeth, and the same tooth showed variations between individuals. The latter, however, were not as marked as the former.

9. The greatest rate of eruption noted for any one tooth was a lower second premolar which erupted 8 mm. in six months. The greatest rate of eruption for any one-year period was that of a lower central which erupted 12 mm. The greatest eruption for any two-year period was that of the lower canine which erupted 13 mm.

10. The increase in rate of eruption takes place long before clinical emergence of the crown.

11. Clinical emergence apparently does not decrease or increase the rate of eruption.

12. Rapid eruption does not start until the crown of the tooth is fully formed.

SUMMARY AND CONCLUSIONS

A report has been made of a study of the rate and amount of eruption of certain human teeth. These were mandibular central incisor, canine, first and second premolar, and first permanent molar. The method employed was serial cephalometric roentgenology followed by the tracing and measuring of certain points on the teeth in relation to the lower border of the mandible, which structure was used as a plane of reference. All measurements were corrected and expressed in millimeters.

Scrutiny of the data reveals that during the period of crown formation there is very little movement of the tooth in an occlusal direction. With few exceptions the increase in the size of the crowns seems to be expressed in an occlusal direction. That is to say, there is no sinking down of the crypt as has been inferred by some authors. The early stages of root formation, however, which follow immediately upon completion of the crown, do show a downward growth of the root of from 2 to 4 mm. This is not accompanied by any acceleration in the occlusal movement of the germ.

After the small amount of root noted above has been formed, the entire tooth begins its most rapid phase of eruption. This is characterized by rapid acceleration in the occlusal movement of the tooth and a slightly less rapid rise of the

forming end. The difference between the two rates is due to the growth of the tooth itself. The rapid phase of eruption continues in most teeth until occlusion is reached, when slowing down occurs. From now on the root is completed by forcing its way down into the bone of the jaw. Upon completion of root formation the entire tooth continues to rise with the occlusal plane. This last point substantiates Gottlieb's contention[7] that there is a perpetual eruption of human teeth.

On the basis of the findings in the report it would appear that there are definite advantages in the use of the technique of cephalometric roentgenology, providing these are accurately controlled. The greatest single advantage lies in the fact that studies can be made on the same living individual over the entire course of the eruption period.

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THE DEVELOPMENT OF THE DENTAL HEIGHT

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THE discussion of the development of the dental height is concerned with the problem of growth. It is necessary, therefore, to review a few fundamental principles of growth before presenting the subject matter.

The simplest definition of growth is a permanent increase in size.[26] This does not necessarily refer to weight, which, while an important factor of growth, is yet not a consistent criterion for growth. It is quite true that as the body increases in size, it necessarily increases in weight; but weight may be gained or lost for other reasons and therefore does not always involve a permanent increase in size.[26]

Arey[1] sums up the phenomenon of growth by stating: "The growth of the body and its parts, organs, and functional systems is a pulsating process which shows marked changes in rate from time to time. Many of these definite periods of alternate acceleration and slowing have been determined and are commonly designated as 'stretching' and 'filling.' "

The various components of this concise statement require amplification. One of these is the rate of growth. Growth rate is never of an even nature. It consists of alternate intervals of acceleration and retardation. These intervals of acceleration and retardation are different with each organ of the body. When one speaks of each organ, or part of the body, as having its own rate of growth, it does not mean that one organ grows at the even rate of 1,000 cells per minute and another at 2,000 cells per minute. One refers, instead, essentially to the particular cycles of acceleration and retardation. For example, one organ may be in an accelerated stage, while an adjacent organ may be in a stage of retardation. With some organs, the period of acceleration may be of a longer interval than with others.

During an accelerated spurt the new outline of a particular part or organ is formed; that is why it is commonly called "stretching." This phase of growth is rapid. It is followed by a period of filling in, or strengthening, of the newly formed tissue, a much slower process. This, then, is the manner in which growth occurs: an increase in the size of the organ, followed by a filling in or strengthening of this addition, and then another spurt of increase in size, etc., until the particular part or organ has reached its maximum growth.

The entire growth cycle of some parts may be short, as in the case of the growth of the cranial bones, which reach their maximum growth potentials at a comparatively early period; the ramus of the mandible, however, continues growing until maturity at the beginning of the third decade of life when, biologically speaking, the growth processes cease.

While these growth cycles of acceleration and retardation are independent for each part or organ of the body, there is an important interrelation between

Read before the annual meeting of the New York Society of Orthodontists, March 6, 1944.

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the growth cycles of adjacent parts. This interrelation may be characterized as a spatial interrelation. One part experiences an accelerated spurt, increasing rapidly in size, to permit a later accelerated spurt of an adjacent part. We are all familiar, to take one illustration, with the sudden growth spurt of the maxilla, which begins at about 4 years of age. This growth spurt is readily observed clinically, for one begins to note appreciable spaces between the deciduous teeth. We are also aware that this accelerated spurt occurs in anticipation of an accelerated spurt of growth of the permanent dentition and its subsequent eruption.

This does not imply that there is a cause and effect relation between the growth of two adjacent parts. It does not imply that the maxilla has this particular spurt of growth because the permanent tooth germs are growing.[2] Each part has its own pattern of growth and is not directly dependent upon the growth of an adjacent part. The maxilla, in other words, would begin to experience this particular accelerated spurt at about 4 years of age, even if there were no permanent teeth developing within the jawbone.

I realize that this touches a controversial aspect, but I still affirm that the growth of the jaws in no way influences or interferes with the growth and development of the teeth, and that the growth and development of the teeth in no way influences the growth of the jaws. Their interrelationship is spatial. If the jawbones do not grow normally and are retarded, the teeth will still develop and grow normally, but will lack the needed room for their proper positioning. With comparatively few exceptions, the teeth will even erupt—in any position, labially, lingually—unless there is a definite mechanical obstruction to prevent the eruption mechanism; and then such isolated teeth will remain impacted within the jaw. But even in these cases, their completed growth and development is not interfered with. There are those in the profession, particularly orthodontists, who will strongly disagree with this view, despite the mass of evidence.

I believe these differences of opinion are due largely to a confusion in concept between function and growth. Function may have an important influence on growth. It is well known that function may have an important influence upon adult tissues, particularly bone, producing all sorts of morphologic changes;[6] and it certainly may have such influences on tissues during growth to an even more marked degree. This discussion, however, concerns not function, but growth.

Besides considering the individual rate of growth for each part, or organ, of the body, we must also give consideration to the general metabolic growth rate. The metabolic growth rate governs the growth rate of each part of the body. This growth rate has a steadily diminishing curve from the beginning of gestation to maturity, at the beginning of the third decade of life, when it becomes negligible. It is estimated, for example, by people who love statistics,[3, 23] that if we were to continue to grow at the general metabolic rate which exists at birth, we would reach a stature of about ten million times the size of the sun. The further we go back in fetal or embryonic life, the more rapid we find the general metabolic rate of growth, and the more fantastic would be the end result if growth were to continue at the earlier rates.

The general rate of growth, therefore, steadily diminishes. The body, for example, increases in length 30 per cent in the first six months of life, and only 50 per cent in the first year of life.[1, 3, 23]

Another illustration of the diminishing general metabolic rate of growth may be observed in Broadbent's composite cephalometric tracings[9] (Fig. 1). The quantitative increase of the dimensions of the mandible diminishes steadily in the recorded intervals of three and one-half years, seven years, fourteen years, and twenty-one years. The last seven-year increment (Fig. 1, *C*) is certainly small.

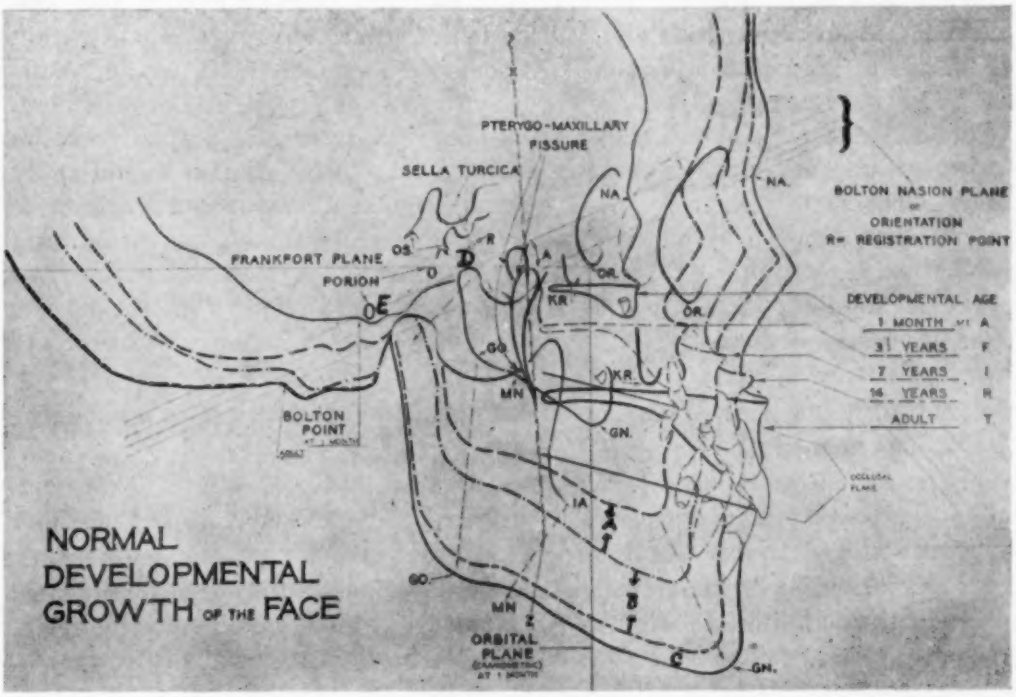

Fig. 1.—Broadbent's composite cephalogram showing the region of the temporomandibular joint at one month at *D*; the region of the temporomandibular joint at the adult stage at *E*, illustrating the downward growth of the temporal bone. *A*, *B*, and *C* show the variable increments of growth at varying age levels. *A* is the three and one-half to seven-year increment. *B* is a seven-year increment, from 7 to 14 years. *C* is the smallest and final increment, from 14 to 21 years.

This diminishing general rate of growth also applies to the development of the teeth. The crown of the first permanent molar tooth, the largest crown in the dentitions, which begins development at birth, is entirely completed in about two and one-half to three years; whereas the maxillary permanent central incisor crown, a smaller crown than the first permanent molar tooth, which begins formation of the hard tissues only about three or four months later, needs four to five years for its completion. This difference is due to the rapidly diminishing general metabolic rate of growth, which, it was mentioned previously, governs the rate of the individual parts of the body.

There is one more aspect of the problem of growth which we will touch upon before we are ready for the specific problem. This is the matter of variation of the various rates of growth in different individuals. There is no specific chronological age at which particular stages of growth need take place for nor-

mal growth and development. Hellman states that graphically,[18] ". . . chronologic ages and stages of development are only remotely related because certain stages in development are reached by some individuals much earlier than by others. As a consequence, the age at which a stage in development is reached varies considerably when larger numbers of individuals are concerned, but the stage attained is nevertheless the same in all. For example, all children in the course of development go through the stage of puberty before they become adults; but some go through it earlier, others later."

One must allow, therefore, a certain amount of variation in the rate of growth, both as regards the general metabolic rate, and as regards the individual cycles of acceleration and retardation of separate parts or organs within the range of normal development. At some such variable limit, we find, however, a definite disturbance of the normal processes of growth and development. While a range of variation chronologically does not disturb the normal processes of growth and development, it need be added that such variation should apply to all of the parts of the body. There needs to be, in other words, a synchronous interrelation between all of the growth spurts of the various parts of the body for normal growth and development. If the growth spurt of only one part or organ is unduly retarded, it will necessarily be out of step with the normal growth and development of the whole, and will disturb the normal growth and development for adjacent parts.

It will be necessary to keep these fundamental observations in mind as we discuss our specific problem.

The region of the dental height may be described generally as those parts of the jawbones within which teeth are developing, plus the teeth in their later varying states of clinical eruption.

This definition of the dental height is at variance with generally accepted views of the dental height, such as Hellman's,[18-21] which limits the dental height region to the area occupied by the clinically erupted portions of the teeth.

At birth, seen from the anterior view (Fig. 2), the dental height would extend from the floor of the nose to almost the lower border of the mandible. At birth there is as yet no clinical eruption. The crowns of the deciduous maxillary incisor teeth occupy the entire vertical dimension of the premaxilla from the floor of the nose to the crest. In the adult stage, there is a tremendous increase in the dimension of the vertical height. This increase is due partly to the vertical growth of the maxilla and of the body of the mandible, and partly to the clinical eruption of the dentition. It is generally maintained that this increase in vertical dimension from birth to the adult stage is brought about primarily by a force of eruption which "wedges" the maxilla from the mandible, thereby increasing the intermaxillary space and permitting room for the clinical eruption of the teeth and the vertical growth of the maxilla and of the body of the mandible.

Hellman states,[18] "With the appearance of the dentition there is a sort of wedging apart of the maxilla from the mandible. The increase in the dimension of height is thus brought about not only by the vertical growth of the face, but also by the addition of the combined height of the crowns of the teeth separating the two jaws."

This view is generally maintained by all observers. The evidence of Gottlieb and Orban, indeed, appears on the surface to be convincing. The following series of illustrations are taken from their text.[16]

Fig. 3 shows a contact relation between the gum pads at about 5½ months of age. There is as yet no clinical eruption of the teeth. This contact relation between the gum pads at this stage, despite the absence of clinically erupted teeth, may be designated as the occlusal plane; there is as yet no intermaxillary space established between the two jaws. I know that there is a good deal of controversy regarding the relationship between the gum pads at birth and at this early stage, but this is not really within the limits of our discussion. I will pass it by with the general statement that we do find considerable variation of relationships between the gum pads at birth.[13]

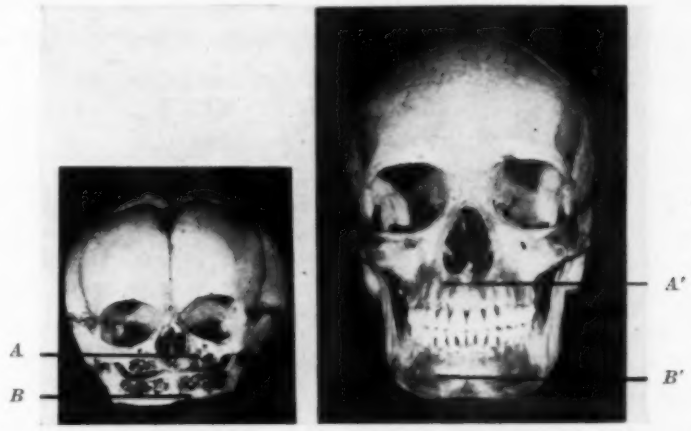

Fig. 2.—The region of the dental height at birth and at the adult stage. At birth it extends from the floor of the nose *A*, to almost the lower border of the mandible *B*. At the adult stage it extends from a short distance below the floor of the nose *A'*, to a short distance above the lower border of the mandible *B'*.

One important factor, however, I should like to make clear: the difference between the physiologic rest position and the centric relation. In the physiologic rest position, the opposing jaws are not in contact relation, regardless of whether the teeth are clinically erupted or not. As we are all aware, in the physiologic rest position only the lips are in contact. There is a variable space, greater in the early months of life, between the opposing jaws; and the tip of the tongue has a tendency to fall lingually to the central incisor region.

Centric relation implies a contact relation between the opposing jaws. There are those who affirm, directly or by implication, that at birth and during the first months of life the opposing jaws are unable to attain a centric relation. From Broadbent's[8, 9] evidence of his cephalograms, it would appear that a centric relation is unattainable until about 2½ years of age. These views are certainly incorrect. If they were tenable it would be necessary to explain how the act of swallowing could be performed without a contact relation of the opposing jaws.

Fig. 4 shows a later stage of development, at 16 months of age. The incisor teeth are in clinical eruption. There is a definite intermaxillary space in the region of the posterior gum pads with evidence of the beginning of clinical

eruption for the first deciduous maxillary molar tooth. This intermaxillary space, it is maintained, is created by the force of eruption of the incisor teeth, which has wedged the opposing jaws apart.

At a still later stage (Fig. 5), in a 21-month-old child, the intermaxillary space is again increased. The deciduous first molar teeth are almost in occlusal contact; the deciduous anterior teeth are considerably more advanced in clinical eruption. Again it is interpreted that, as the anterior teeth continued eruption, the opposing jaws were steadily wedged apart so that the intermaxillary space increased. Each pair of succeeding teeth erupting in the mouth would therefore erupt into an increasingly greater intermaxillary space; and whenever occlusal contact between any two opposing teeth was reached, assistance in wedging the jaws apart would thereby be given.

This phenomenon is presumed to continue until the adult occlusal plane is reached, at which time the intermaxillary space is presumed to remain stable

Fig. 3.

Fig. 4.

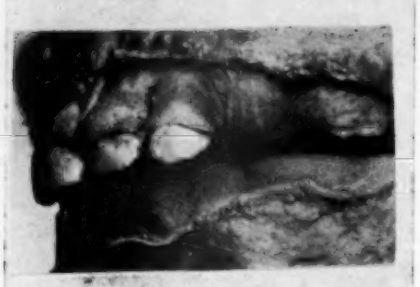

Fig. 5.

Fig. 3.—The contact relation between the edentulous gum pads at 5½ months of age.

(Figs. 3, 4, and 5 taken from Gottlieb, B., and Orban, B.: Biology and Pathology of the Tooth and Its Supporting Mechanism, New York, 1938, The Macmillan Co.)

Fig. 4.—The intermaxillary space between the posterior edentulous gum pads with evidence of the beginning of clinical eruption of the maxillary first deciduous molar. Age, 16 months.

Fig. 5.—Increased intermaxillary space between the opposing jaws. The first deciduous molars erupted in occlusal relation and evidence of increased clinical eruption of the anterior teeth. Age, 21 months.

as the result of a continuous attrition of the masticating areas of the opposing teeth, which is compensated for by an equivalent degree of clinical eruption.

It is further maintained, theoretically, that if attrition did not occur, the force of eruption would continue to wedge the opposing jaws apart and would result in a markedly elongated face.

Schour and Massler[24] also support this view as a result of their experimental growth studies: "Normally, the vertical height of the jaws and the length of the arch are increased by the eruption of the teeth. In hypopituitarism, the failure in eruption results in an insufficient increase in vertical height and arch length so that the teeth, the crowns of which are of normal size, may become crowded or submerged."

In other words, the pituitary deficiency primarily affects the eruptive force of the teeth, so that the teeth are unable to erupt, with the result that the jaws cannot be spread apart and the vertical height of the jaws fails to increase.

As I have indicated, Broadbent's view differs from these only as far as the first two and one-half years of life are concerned. In his composite cephalometric tracings[8, 9] (Fig. 1) from 1 month of age until maturity, a considerable intermaxillary space is represented as existing between the opposing jaws in all stages of normal growth and development up to 2½ years of age. All his later stages, at 2½ years, 7 years, 14 years, and 21 years, are represented to be in centric occlusion. These representations in this composite picture of normal growth and development are subject to only one interpretation, that, in the first two and one-half years, there is sufficient intermaxillary space for the vertical growth of the maxilla and of the body of the mandible, as well as for the clinical eruption of the deciduous teeth, but that from 2½ years on, the wedging of the jaws occurs by the force of eruption.

FINDINGS

My evidence does not support these views. This evidence is concerned partly with a characteristic complex of phenomena associated with the delayed eruption time of the first permanent molar teeth. In each case (Fig. 6, *A*) the x-ray disclosed normal development of the first permanent molar teeth and normal position within the jawbones. Their crowns were fully developed, the roots had begun to form, and the coronal alveolar bone was completely resorbed, with only gingival tissues covering the occlusal surfaces.

A comparative study of the x-rays taken at varying intervals (Fig. 6, *A, B, C, D, E,* and *F*) disclosed that the first molar teeth remained unchanged in their positions despite the lapse of time, but that their roots were continuing to grow in length, deeper within the jawbone. This is certainly the reverse of the normal physiologic growth process, which gives evidence of clinical eruption occurring as the root of the tooth forms in length. The epithelial sheath in these cases surely could not be regarded as a relatively fixed point, for it must be proliferating deeper within the jawbone.

A study of the occlusal relation of the opposing dentitions revealed a total absence of intermaxillary space between the opposing posterior edentulous gum pads (Fig. 7, *A* and *C*); it showed, rather, a contact relation between them. A

clinical examination revealed further that the surface gingiva of the edentulous areas were appreciably flattened and highly keratinized, indicating a functional contact of long standing.

The normal expectancy, from these x-ray findings, of imminent clinical eruption proved disappointing. Their persistent retention during periods of observation of six months, a year, in some cases a year and a half, and in one case two and a half years proved baffling.

A closer study revealed a number of interesting findings. For this study maxillary and mandibular impressions were taken of all cases. Care was exercised to include not only the teeth but the edentulous areas posterior to the second deciduous molar teeth as far as, and including, the gingival tuberosities. Models were made and articulated.

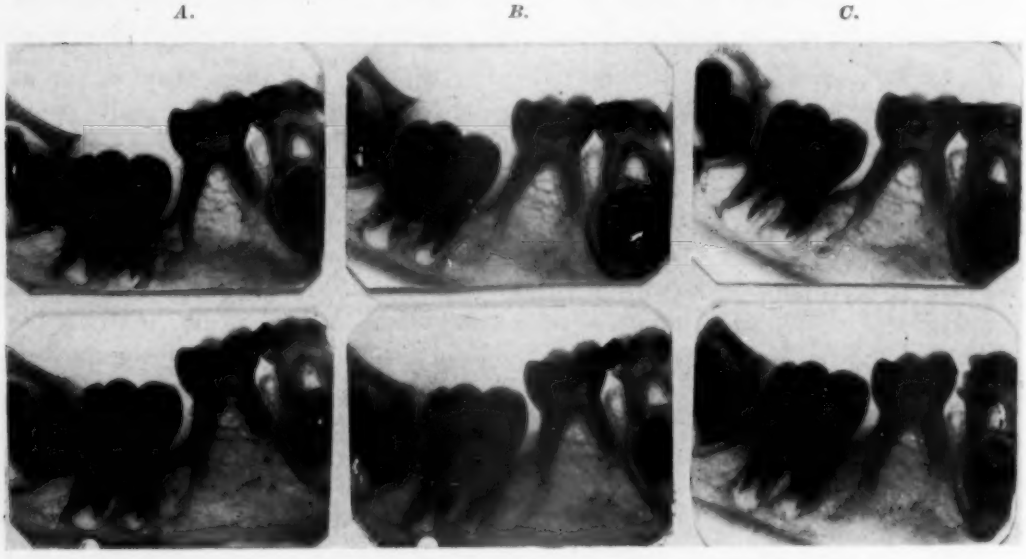

Fig. 6.—*A*, x-rays of a mandibular first permanent molar of a child 7½ years of age, showing normal growth of the roots for the chronological age, resorption of coronal bone and no evidence of clinical eruption. *B*, *C*, *D* and *E*, x-rays of the same region taken at approximately three-month intervals, illustrating no change in the position of the tooth except for continued growth of the root deeper within the jawbone. Note *F*, x-ray of the same region taken Nov. 6, 1943, one month before the ninth year and two months after the x-ray shown in *E*. This x-ray was accordingly taken after this report was completed. It is included in this report because it now shows a slight vertical migration of the tooth. Associated with this is the appearance of a slight intermaxillary space between the opposing edentulous gum pads posterior to the second deciduous molar teeth, indicating that the ramus is now beginning to grow in length.

In all cases the growth of the edentulous area posterior to the second deciduous molar tooth in both the maxilla and the mandible appears normal in an anteroposterior direction (Fig. 7, *A* and *C*).

There is certainly sufficient posterior growth to allow for the normal eruption of more than the first permanent molar teeth. Lateral growth also appears to be normal.

In all of these cases an overbite relation (Fig. 7, *B*) could be observed between the anterior deciduous teeth. This anterior overbite relation definitely increased with time.

C.

B.

A.

Fig. 7.—Three views of a dentition in occlusal relation of a child 7½ years of age. *A*, right lateral; *B*, frontal; *C*, left lateral. *A* and *B* show the anteroposterior extent of the edentulous area posterior to the second deciduous molar and the contact relation between the opposing edentulous gum pads with an absence of intermaxillary space. The frontal view, *B*, shows the extent of the anterior overbite relation.

DISCUSSION

These twelve cases of delayed eruption time of the first permanent molar teeth all present the same general characteristic complex of phenomena.

The anteroposterior growth of the edentulous area posterior to the second deciduous molar teeth is normal.

The permanent first molar teeth are developing and continue to develop normally for the chronological age.

Their roots continue to grow in length, but deeper within the jawbones.

The coronal bone of these teeth is entirely resorbed.

In centric occlusion the edentulous posterior gum pads are in contact relation, with a total lack of intermaxillary space.

And finally, the anterior teeth are in an overbite relation.

As one correlates these findings, it is quite apparent that only one factor is responsible for the persistent submergence of the first permanent molar teeth. This factor is the lack of intermaxillary space. It is equally apparent that the lack of intermaxillary space can be due only to a retardation of growth-length of the ramus of the mandible. *The force of eruption, therefore, plays no part in increasing the intermaxillary space by wedging the jaws apart, and plays no part in increasing the vertical dimensions of the dental height.*

Instead, the increase in the vertical height is dependent upon the growth in the length of the ramus of the mandible. The accelerated spurts of growth in the length of the ramus cause the body of the mandible to recede steadily from the rest of the face, thus increasing the intermaxillary space, and permitting vertical growth of the maxilla and of the body of the mandible as well as the clinical eruption of the teeth.

Other studies corroborated this conclusion and disclosed additionally that, for about the first five years of life, the downward growth of the temporal bone contributed to the lowering of the entire mandible.[11] For as the downward growth of the temporal bone occurs, the mandible necessarily must be lowered during the period of the growth stage of the temporal bone. Broadbent's composite cephalometric tracings[9] (Fig. 1, *D* and *E*) also illustrate the downward growth of the temporal bone in the early years.

ADDITIONAL FINDINGS

Having established the negative evidence for the dependency of the vertical growth of the dental height upon the vertical growth of the ramus of the mandible, I was desirous of examining the positive evidence. To this end, it was necessary to study the intermaxillary space relationships of a single individual at sequential chronological intervals, particularly prior to and following the clinical eruption of additional teeth. The earlier periods seemed more desirable. Such an investigation, now in progress, would necessitate some seven or eight years before the necessary evidence were obtainable.

A search of the literature proved very disappointing. Very few models of the first eight years could be found. Those that were found, as well as the large mass of reproductions of the puberty and adolescent periods published by orthodontists, were, by and large, not concerned with the evidence of growth

of the jawbones, but only with the presence of the number of teeth and their arrangement. Practically all the published photographs of orthodontic models were trimmed close to the most posterior tooth. The edentulous regions posterior to the last clinically erupted teeth and extending as far as the tuberosity were invariably wanting.

The only published records of the early years, therefore, of interest to this problem, were those of Sillman.[25] Sillman has undertaken an important study. His objective is to take impressions at various intervals of the same individual from birth to maturity. I believe he has been engaged in this study for about six years and his records therefore extend approximately to that age.

I am indebted to Dr. Sillman for permitting me to study some of his material. His project is so important, his task so difficult, and his patience in taking these impressions of babies and young children so commendable, that it would appear unreasonable to make any criticism of his procedure. Regrettably, in most of the models I observed, the full extent of the edentulous posterior gum pads were lacking in the original impression. In addition, most of his models were not articulated in centric relation.

Fortunately, one series of his models proved adequate. They were all articulated in centric occlusion, and for the most part the posterior edentulous gum pads were intact. This series (Fig. 8) gives records of a child at 2 years, 1 month, and 3 days (Fig. 8, *A*), 2 years, 8 months, and 14 days (Fig. 8, *B*), 3 years, 2 months, and 10 days (Fig. 8, *C*), and 6 years and 14 days (Fig. 8, *D*).

At 2 years, 1 month, and 3 days (Fig. 8, *A*), the growth stage is set for the eruption of the second deciduous molar teeth. The palatal view (Fig. 8, *E*) shows considerable growth anteroposteriorly and a long edentulous area posterior to the first deciduous molar teeth. The ramus has had its accelerated spurt, as evidenced by the intermaxillary space between the posterior gum pads, in anticipation of the eruption of the second deciduous molar teeth. Growth of the jawbones has indeed taken place in all dimensions in anticipation of the eruption of these teeth. About seven and one-half months later (Fig. 8, *B*), the picture has changed; the second deciduous molar teeth have erupted and are now in occlusal relation; and the previously existing intermaxillary space is eliminated. Posterior to the second deciduous molar teeth a much reduced intermaxillary space is noted. This indicates that the ramus-growth-length is in a state of retardation whereas the vertical growth of the maxilla and of the body of the mandible are experiencing accelerated spurts, the maxilla growing downward and the body of the mandible growing upward.[4]

Four months later (Fig. 8, *C*) the intermaxillary space posterior to the second deciduous molar teeth is virtually eliminated. Regrettably, for the long gap of almost three years, the record is lacking; but at 6 years and 14 days (Fig. 8, *D*), one again notes the considerable intermaxillary space between the posterior gum pads, indicating another appreciable accelerated spurt in the growth-length of the ramus in anticipation of the eruption of the permanent first molar teeth.

This evidence, while representing only four chronological intervals of an individual—at 2 years, 1 month, and 3 days; 2 years, 8 months, and 14 days; 3 years, 2 months, and 10 days; and 6 years and 14 days—is sufficient to support

the biologic principle of growth by alternate cycles of acceleration and retardation and the principle of the synchronous interrelation of growth spurts of adjacent parts to illustrate the phenomenon of spatial interrelation. An accelerated spurt in growth-length of the ramus has occurred in the period preceding 2 years, 1 month, and 3 days. In the next two stages, covering a period of about one year, the ramus-growth-length is in a state of retardation, during which time the vertical dimensions of the maxilla and of the body of the mandible are increasing simultaneously with the clinical eruption of the second deciduous molar teeth. This continues until the intermaxillary space is closed up; then another accelerated period in ramus-growth-length ensues until sufficient intermaxillary space is again established for the clinical eruption of the first permanent molar teeth and the continued vertical growth of the maxilla and of the body of the mandible.

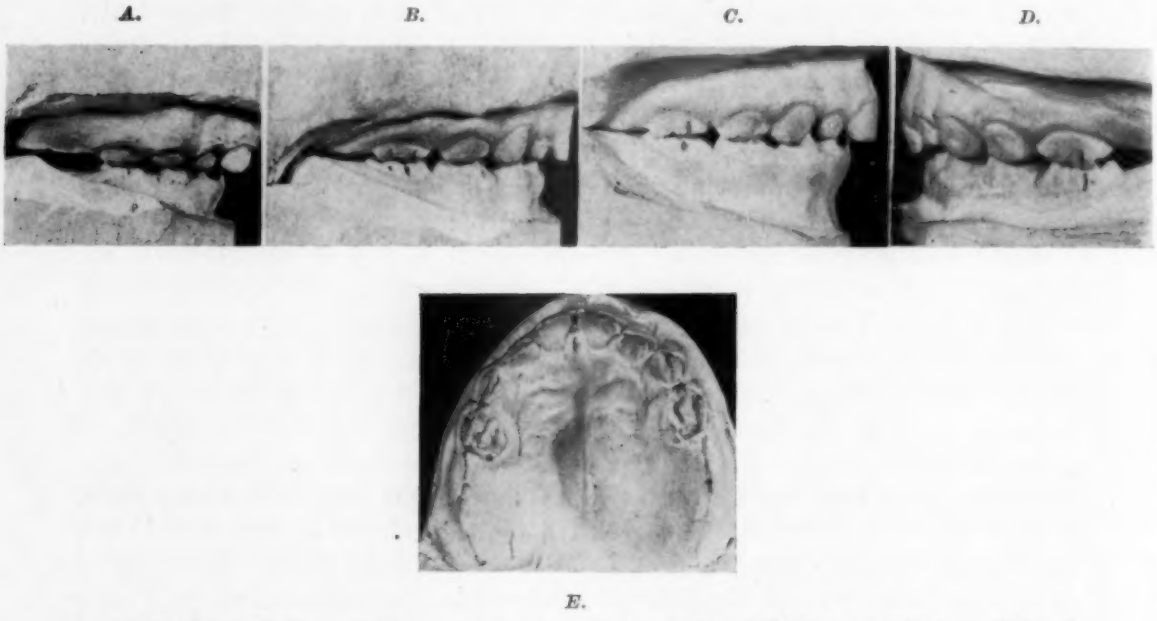

Fig. 8.—*A*, *B*, *C*, and *D*, a series of lateral views of the dentition of a child at different ages. *A*, at 2 years, 1 month, and 3 days, all but the second deciduous molar teeth are clinically erupted and in occlusion. Posterior to the first deciduous molar teeth an intermaxillary space is seen between the edentulous gum pads. Note that mandibular impression did not extend as far as the tuberosity. *B*, the same child seven months later, at 2 years, 8 months, and 14 days. The second deciduous molar teeth are erupted and in occlusion. The intermaxillary space of the edentulous gum pads posterior to the second deciduous molar is appreciably reduced. *C*, The same child four months later at 3 years, 2 months, and 10 days. The edentulous gum pads posterior to the second deciduous molar teeth are in contact relation. No intermaxillary space. *D*, The same child at 6 years and 14 days. An appreciable intermaxillary space is noted between the edentulous gum pads posterior to the second deciduous molar teeth. *E*, Palatal view at 2 years, 1 month, and 3 days, showing the extent of anteroposterior development of the edentulous area posterior to the first deciduous molar tooth.

It will be necessary to study a large number of cases at more regular chronological intervals before the normal extent of ramus-growth-length is determined for each accelerated interval.

The biologic principle, however, is clear; and it is in agreement with the mechanism of growth phenomena between adjacent or related structures elsewhere in the body.

Arey[1] states, "The thigh bone increases in thickness for six months, while

the leg bones are rapidly elongating and vice versa. Similar examples of complementary development are observed in such adjacent structures as heart and lungs, liver and intestine."

C.

B.

A.

Fig. 9.—Three views of the dentition of a 27-year-old female, showing the presence of only two permanent maxillary central incisor teeth; the remainder are all deciduous teeth. There is a congenital absence of thirty of the permanent dentition. *A* and *C*, the lateral views. *B*, the frontal view. Note the extent of the anteroposterior development of the edentulous gum pads posterior to the second deciduous molar teeth, and the appreciable intermaxillary space between the edentulous gum pads.

RELATION OF GROWTH AND DEVELOPMENT OF JAWS AND TEETH

There is still one more piece of evidence of interest to this problem. Fig. 9 shows the case of marked anodontia of a 27-year-old woman.[15] All of the permanent teeth, with the exception of the two maxillary central incisor teeth,

are congenitally absent. Most of the deciduous teeth are still retained. A study of the growth and development of the jaws in the three dimensional relations, on which Dr. Hellman kindly cooperated with an anthropometric study, shows that growth has not been interfered with, despite the congenital absence of thirty of the permanent dentition. There is sufficient anteroposterior growth of the jawbones, as noted by the spacings between the deciduous teeth and the wide edentulous posterior gum pads, to accommodate the full complement of the permanent dentition. The vertical dimension of the dental height is within the range of a normal full complement of the permanent dentition; and the intermaxillary space noted in the region of the edentulous posterior gum pads (Fig. 9, *A* and *C*) is quite sufficient for the eruption of the permanent molar teeth. One notes a phenomenon, commonly occurring, of continued vertical growth of bone in the absence of teeth, so that in some localized areas the intermaxillary space appears reduced.

These findings are strongly in support of the conclusion that there is no cause and effect relation between the development of the teeth and the development of the jawbones, for the case illustrates convincingly that the jawbones in all dimensions have grown and developed within the range of the normal, despite the congenital absence of all but two of the permanent dentition. Brodie and Sarnat[12] reported a study of complete anodontia with identical findings.

PRACTICAL IMPLICATIONS AND CONCLUSIONS

Besides the evidence of the persistent submergence of the first permanent molar teeth and the absence of intermaxillary space between the posterior edentulous gum pads, observation was also made of a steadily increasing anterior overbite relation (Fig. 7, *B*) as an aspect of the ramus-growth-length retardation complex. This requires additional explanation.

It is well known that, in the absence of opposing occlusal contact, teeth will continue in active clinical eruption. If, as in the group of cases presented, the ramus does not grow in height, the intermaxillary space will not increase; and then not only do the first permanent molar teeth remain submerged, but the continuous active eruption of the deciduous posterior teeth becomes inhibited.

But this does not interfere with the continuous eruption of the anterior teeth. The longer the accelerated spurt in growth-length of the ramus is retarded, the greater the anterior overbite will become. As soon as the anterior overbite is established, a vicious cycle is immediately in operation; for the anterior overbite relation inhibits the forward growth of the anterior part of the mandible. It is additionally revealing that in all of these cases the mandibular permanent incisor teeth erupted in lingual relation.

I believe, therefore, that a percentage of cases of malocclusion are primarily the result of an undue period of retardation in growth-length of the ramus.

Evidence has been presented to demonstrate that the complementary principle of growth between adjacent organs, structures, or parts of the body is also operative in the growth and development of the dental mechanism. This evidence demonstrates that the intervals of acceleration in growth-length of the ramus precede the intervals of the clinical eruption of teeth and the vertical

growth of the maxilla and the body of the mandible. As the intervals of growth in the length of the ramus occur, the intermaxillary space increases.

This is followed by a closing up of the intermaxillary space, due to the clinical eruption of the teeth and to the apposition of bone at the crests of the maxilla and of the body of the mandible. During this period, the growth in length of the ramus is in a state of retardation. This principle of complementary growth of adjacent parts may be characterized as the phenomenon of spatial interrelation. It was also noted that in the first five years of life, the downward growth of the temporal bone contributed to the lowering of the mandible, thereby increasing the intermaxillary space.

An analysis of the Schour-Massler statement reveals no disagreement with these conclusions. They observe that in hypopituitarism the skeleton as well as the jaws are appreciably retarded in growth.

Accordingly, growth in the length of the ramus is equally retarded. They observe that the teeth develop normally, but remain submerged within the jawbone; but they then conclude that the underdevelopment of the anteroposterior and vertical dimensions of the jawbones is due to the failure of the clinical eruption of teeth. This conclusion is unwarranted.

It is more tenable that the explanation for the persistent submergence of the normally developed teeth will be found in the underdevelopment of the jaws in all dimensions, particularly in the retardation of the ramus-length.

It is also apparent that the conclusions of former investigators that the intermaxillary space kept continuously increasing as the result of the force of clinical eruption, is due to their observance of the intermaxillary space relation during only the accelerated growth intervals of ramus-length.

Evidence of the increasing anterior overbite relation associated with the undue retardation in ramus-growth-length points strongly to the lack of ramus-growth-length as the etiological factor in a group of malocclusions.

One may definitely regard the ramus as the "pacemaker" in the development of the vertical dimensions of the jawbones. This is contrary to the views of Keith and Campion,[22] who, while they recognized the possible need for a pacemaker in the growth and development of the face, believed it to be the complex phenomenon of upper facial growth, to which mandibular growth was adaptive.

Definite periods of alternate acceleration and slowing have been determined for many organs or parts of the system. It will be necessary to determine the definite intervals of acceleration and retardation of growth in, particularly, the jawbones and, further, in all the bones of the skull. Only then will the phenomenon of complementary growth, or the principle of spatial interrelation, be understood. When these definite growth spurts for each part have been determined, with their range of normal physiologic variable limits, we can more readily recognize an unduly delayed growth spurt of any part.

I am firmly convinced that such unduly delayed growth spurts are associated with some metabolic disturbance affecting skeletal growth. A study in this direction may serve in the future to prevent a large group of malocclusions and obviate the necessity of utilizing appliances.

In the meantime, I believe that the evidence presented may afford valuable diagnostic aid in determining an important etiological factor of a group of potential malocclusions. A potential development of malocclusion may be readily apprehended by taking congnizance of unduly delayed eruption in conjunction with the lack of intermaxillary space relation between the opposing edentulous posterior gum pads. From the standpoint of prevention, close scrutiny of these phenomena during the periods of expectancy of clinical eruption of additional teeth, particularly in the first eight years of life, should prove rewarding; for as soon as an anterior overbite relation develops with a concomitant lack of increase of the intermaxillary space in the posterior edentulous region, intervention of some kind is indicated.

SUMMARY

1. Evidence has been presented that the force of eruption is not the primary factor in increasing the dental height or the vertical dimensions of the jaws.

2. Instead, growth in the length of the ramus causes the mandible to recede from the maxilla, thereby increasing the intermaxillary space.

3. During approximately the first five years of life, the downward growth of the temporal bone contributes to the lowering of the mandible.

4. When an intermaxillary space is established, the ramus-growth-length is slowed or retarded and the clinical eruption of teeth along with the vertical growth of the maxilla and of the body of the mandible occurs.

5. This complementary manner of growth of adjacent parts or growth by spatial interrelation is a recognized biologic phenomenon.

6. Lack of growth in ramus-length will produce a characteristic series of growth disturbances:

   a. The intermaxillary space fails to increase.
   b. The teeth cannot erupt and remain submerged, their roots growing normally but deeper within the jawbone.
   c. The vertical dimensions of the maxilla and of the body of the mandible fail to increase.
   d. The anterior teeth continue in eruption resulting in an overbite relation.
   e. The anterior overbite relation will inhibit the forward growth of the anterior part of the mandible.

7. The ramus-growth-length is therefore regarded as the "pacemaker" for the normal growth and development of the dental mechanism or the lower face.

8. There is no direct cause and effect relation between the growth and development of the jaws and the growth and development of the teeth.

9. There *is* a factor of spatial interrelation between the growth of the jaws and the clinical eruption of the teeth.

10. Early recognition of an unduly delayed growth in ramus-length may prevent the development of a group of malocclusions.

11. It is believed that the retardation of growth in ramus-length is due to a metabolic factor.

12. The extent of duration of the accelerated growth intervals of ramus-length should be further studied.

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200 CENTRAL PARK SOUTH

SURGICAL AND ORTHODONTIC CORRECTION OF PROGNATHISM

A. W. McClelland,* Montreal, Canada

THE aim in presenting this case report is not wholly to show the close relationship between the orthodontist and the plastic surgeon, but rather to point out that a great many individuals can only be helped by the services of both orthodontist and plastic surgeon.

Orthodontists have, as a general rule, remarkable success with mandibular prognathism, especially at early ages, but frequently we find individuals of adult life so deformed that orthodontic procedure is not sufficient of itself to correct the condition; these are the cases or individuals that I refer to.

Briefly, these cases may be divided into two groups:

Group A.—Those that do not require orthodontic treatment prior to the surgical operation.

Group B.—Those that require orthodontic treatment or expansion of the superior maxillary arch prior to the surgical operation.

The illustrations following will show a case of mandibular resection.

The case that I am presenting is one of Group A, or one that did not require orthodontic treatment previous to the operation.

The patient was a man 32 years old, married and having four children. As far as his history can be obtained, he has had since early childhood, some sort of bilateral mesioclusion or mandibular prognathism.

Later in life this condition was complicated by the loss of permanent teeth, so that when he reported to the Royal Victoria Hospital he was suffering from a stomach ailment presumably caused by almost entire lack of mastication. (Figs. 1, 2, 3, and 4.) He was also in a run-down nervous state and was self-conscious to the extent that he refused to eat with the family, and his wife had to serve him his meals alone.

After consultation with members of the hospital staff, it was felt that the only way this man could be helped was by a mandibular resection, which would give him occlusion and enable him to masticate his food.

Appliances were placed on the teeth of both maxillary arches, prior to the surgical operation. On the teeth of the upper arch, bands were fitted, carrying half-round tubes, molar attachments throughout. A base wire, gold and platinum, 0.035 inch in diameter, was fitted into the attachments mentioned. Several loops were soldered to the alignment wire to be used as required for interdental wiring; this completed the appliance for the upper teeth.

The mandibular anterior teeth were banded in a similar manner also using molar half-round tubes. The second and third molars on either side were banded and the bands on the respective sides soldered together. To these bands were soldered on both sides a horizontal round tube 1 inch long. The horizontal tubes

Presented before the New York Society of Orthodontists, March 7, 1944.

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were of such diameter that the side ends of the arch wire could telescope with ease.

These horizontal tubes were used with the thought that when the pieces of bone were removed by the surgeon, the three parts of the mandible could be drawn together, uniting these parts closely and most securely. Thus the telescoping of the alignment wire in the horizontal tube permitted of this. (Figs. 5 and 6.)

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Now a word about the pieces of bone that are to be removed from the horizontal rami of the mandible. It rests with the orthodontist to dictate the size and shape of the pieces of bone to be removed, as determined by the occlusion that he has in mind. Here the orthodontist's advice is very important be-

cause of the fact that he knows occlusion and the surgeon may not be so familiar with it.

Many casts were made of the mandibular teeth and bone as far as an impression would permit. These casts were sawed in pieces and the parts approximated, and, after many attempts, the size of the segment of bone that was to

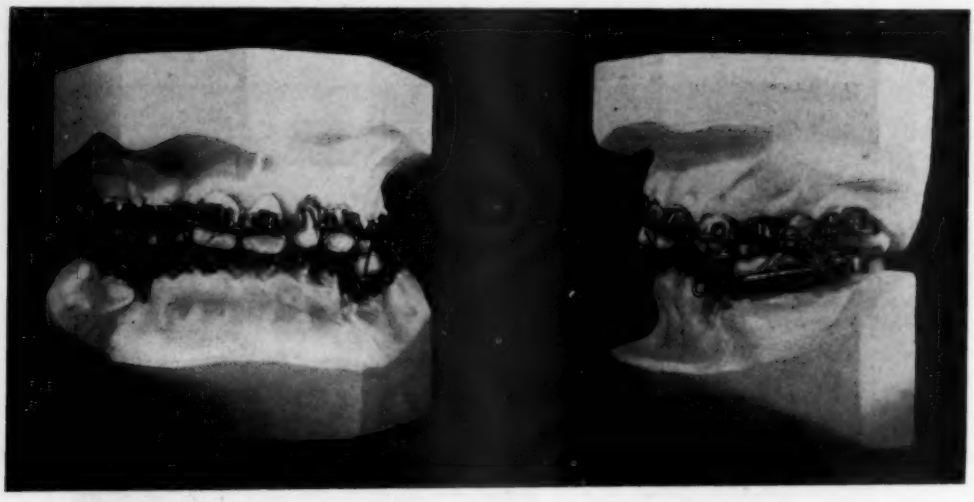

Fig. 5. Fig. 6.

Fig. 7.

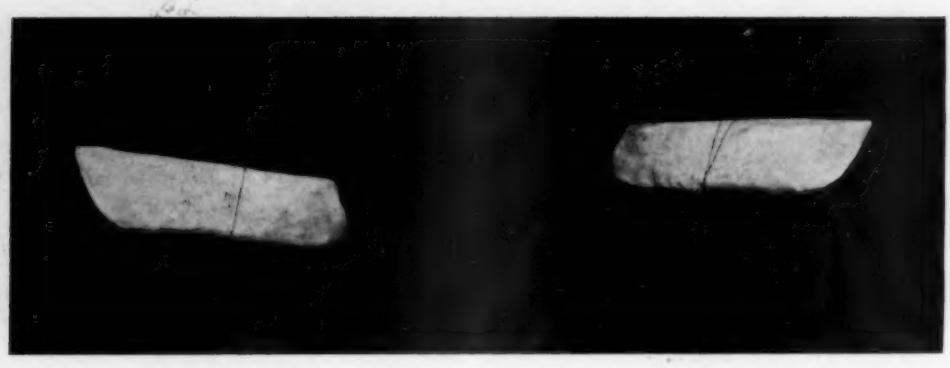

Fig. 8. Fig. 9.

be removed from either side was decided upon; the shape of the pieces of bone also must permit the closest approximation of the mandibular parts, for obvious reasons. (Figs. 8 and 9.)

The surgical operation may be briefly described as follows: An incision, about 1 inch long, was made along the inferior border of the mandible in the premolar region on each side. The periosteum was raised from the bone up to the alveolar ridge on the inner and outer aspect of the mandible. A segment of bone, the size of which has been previously referred to, was then removed with

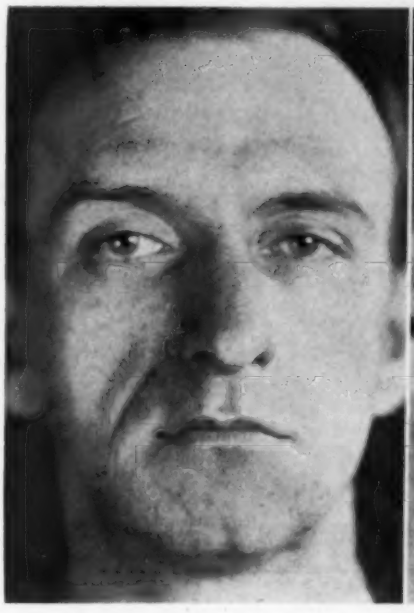

Fig. 10.

Fig. 11.

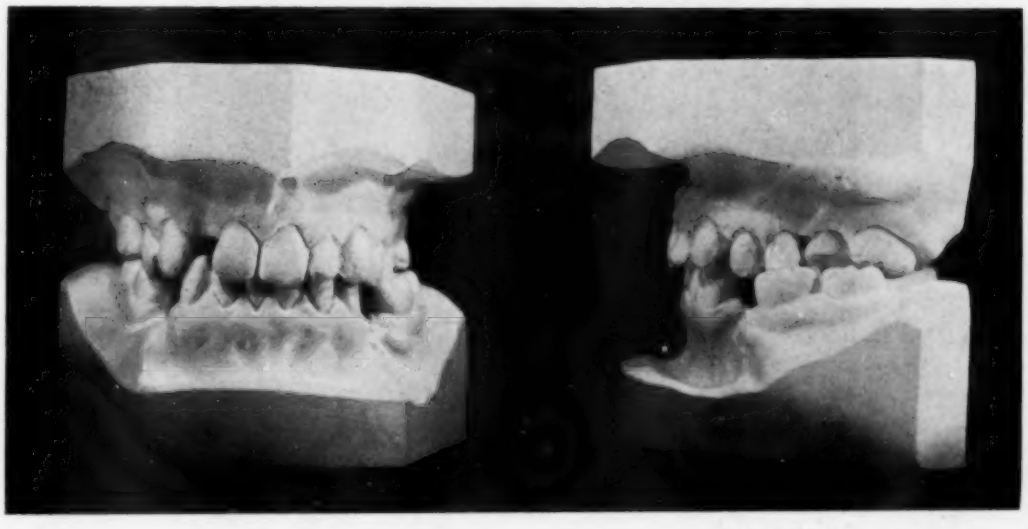

Fig. 12.

Fig. 13.

a saw. No effort was made to save the inferior dental nerve and artery. The alveolar mucosa was incised to aid in the removal of the segment of bone on each side, but none was excised. This was sutured with fine interrupted wire sutures. The three fragments of the mandible were then brought together and held in

proper relationship with previously prepared orthodontic appliances. The occlusion of the teeth was found to be satisfactory and the splints were secured. The jaws were then wired together with intermaxillary loops. (The incisions were completely healed in about ten days.)

Fig. 14.

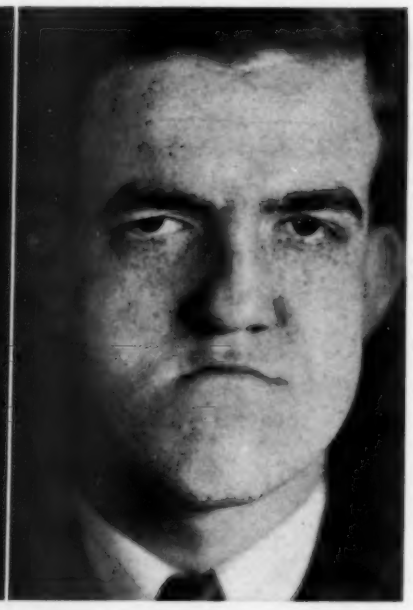

Fig. 15.

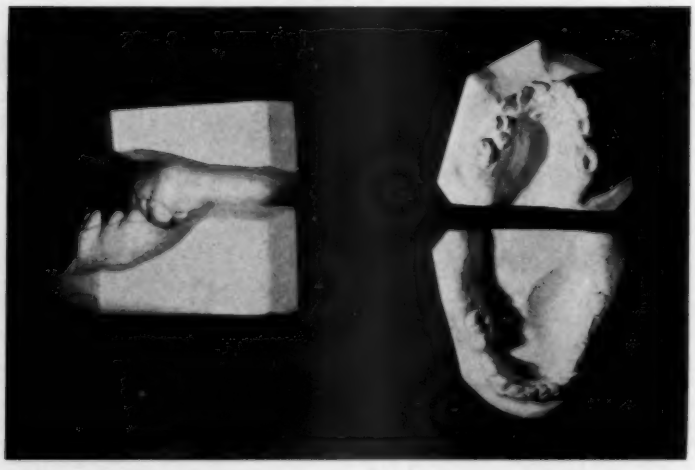

Fig. 16.

Fig. 17.

The patient was dismissed from the hospital twelve days after the operation, his jaws still ligated interdentally. The recovery was good and he returned to work in about two and one-half months' time. (Figs. 10, 11, 12, and 13.)

Figs. 14, 15, 16, and 17 will show the class which I referred to as requiring movement of teeth prior to any surgical operation.

606 Drummond Building

DISCUSSION

Dr. Glenn F. Young.—In the first case which you showed, did the patient experience any difficulty in developing the necessary musculature so as to chew comfortably after the treatment was completed?

Dr. McClelland.—No, after a certain period he could chew quite comfortably. Of course, he had to be fed very delicately for some time. He could not chew very well when the jaws were freed interdentally.

Dr. Young.—How long did it take to develop the muscles so that there was no tired feeling?

Dr. McClelland.—In six weeks he was doing very well and eating comfortably enough to sustain his bodily needs and get back to work.

Dr. Donald B. Waugh.—Was any paranesthesia experienced as a result of the operation in the anterior region in the case in which Dr. McClelland said he made no attempt to save the nerve?

Dr. McClelland.—Yes, temporarily. The patient complained, for about six months, of lack of sensation in the chin in general, especially while shaving. This passed off gradually, and now, after two years, he has complete sensation and his teeth give a very good vitality test.

Dr. A. C. King.—I should like to ask Dr. McClelland why he proposed to do the surgical operation in the second and third cases.

Dr. McClelland.—Because there is no other way that I know, as I said in my paper, of giving these individuals a practical occlusion. After all, teeth can be moved only so far.

Dr. Andrew F. Jackson.—This section of the horizontal body of the mandible is always a very dangerous operation on account of infection, and a great many cases are being treated successfully extraorally by sectioning the ramus in both phases. I should like to ask why he did not section the ascending ramus, which could be done extraorally?

Dr. McClelland.—Some of these questions might perhaps be better answered from the clinic table. However, I will do my best. I did not get the last question concerning the ascending ramus.

Dr. Jackson.—We had a case reported yesterday by Dr. Hemley, which was operated on extraorally, in which, as you know, there is less danger of infection than when it is done intraorally. In Philadelphia, we have Dr. Cameron and Dr. Ivy who have done quite a number of these operations extraorally, and I thought perhaps you had considered both phases. Why did you think the extraoral should be discarded and the intraoral performed?

Dr. McClelland.—We thought (the surgeon and myself) that the intraoral operation was preferable. With the advent of the sulfa drugs, I do not think possible infection is viewed as seriously as formerly. In the second place, I do not think occlusion can be effected so well by operating on the ascending ramus as on the main body of the mandible. Occlusion is the main factor in operating. There is little room between the temperomandibular articulation and the place where the nerve dips into the bone; also, this part is very thin and weak. I do not think as strong a joint can be established here. Also, if infection takes place, I would rather have it removed as far from the temperomandibular joint as possible.

A UNIQUE WELDING JIG FOR ATTACHMENT BRACKET CONSTRUCTION

M. Alden Weingart, D.D.S., New York, N. Y.

INDUSTRIAL efficiency involving the mechanical union of two pieces of metal is predicated on the preparation of a guide or jig which will hold the parts together during the operation so that the resulting union will be of uniform precision each time the operation is performed. In this manner the margin of error is eliminated and the ease and speed of operation is increased to a maximum.

Adapting this basic principle to our work, a welding jig is herewith presented which serves as a guide for the precise positioning and welding of various attachment brackets to strips of band material in the preparation of such bands.

Fig. 1.

Fig. 2.

Fig. 3.

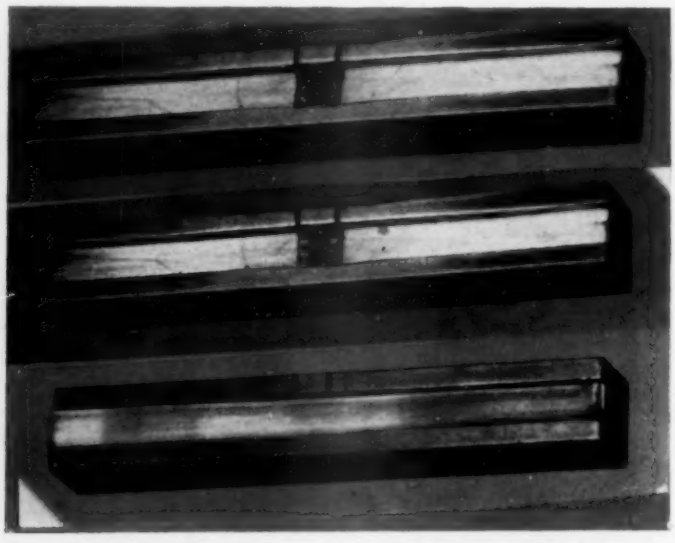

Fig. 1.—Jig prepared to receive universal brackets.
Fig. 2.—Universal bracket in position.
Fig. 3.—Band strip in position.

The jig consists of ¼ inch square brass rod 2 inches in length. On one side a slot is milled to the exact width of the band material used. In the center of this slot a counterpart of the face of the attachment is drilled. (Fig. 1.)

In operation, the attachment is dropped into the prepared counterpart (Fig. 2) and the strip of band material placed over it (Fig. 3).

Presented before the meeting of the American Association of Orthodontists in Chicago, April 25, 1944.

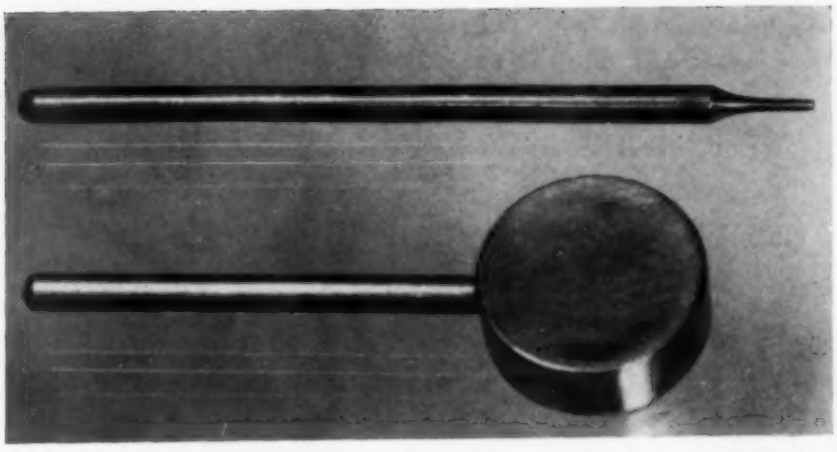

Fig. 4.—Upper and lower electrodes.

Fig. 5.—Welding assemblage.

A straight electrode is used in the upper support of the welder. The lower electrode consists of a miniature table upon which the jig is placed (Fig. 4).

The welds are made opposite the indicated scratch lines marked on the side of the jig (Fig. 5).

Fig. 6.—Completed weld.

The jig is best made from a hardened brass alloy and may be adapted for welding of any type of attachment bracket.

Illustrated (Fig. 6) is the universal bracket welded in this manner.

119 West 57th Street

REPORT OF THE COMMITTEE ON EDUCATION

Throughout the last two years the teaching of orthodontics has been subjected to the same modifications and difficulties which have affected the general teaching of dentistry during this critical period. Most of these difficulties are related to the following major changes which occurred in the majority of the dental schools:

1. Institution of accelerated programs of education as a part of the war effort.
2. Decreases in the total teaching time in the curriculum as a result of the ruling of the Council on Dental Education.
3. Reduction in the teaching staffs of the schools because of recruitment by the Armed Forces.
4. Restriction of the graduate programs because of unavailability of students.

These altered conditions have operated in varying combinations and to varying degrees among the schools. Each school and each department within the schools has had a constantly shifting pattern of problems to meet during these early years of the war. The most encouraging result of this period of stress appears to be an increasingly realistic attitude among school administrators as they have re-examined the objectives and programs of their schools.

This increasing realism on the part of many deans has been evident during the Orthodontic Group Conferences of the last two meetings of the American Association of Dental Schools. Numerous deans have attended and actively participated in these Group Conferences. Doubtless the frank exchange of opinions during these conferences has made some progress in clarifying and defining the problems associated with orthodontic teaching and the place of orthodontics as a part of the total curriculum. It is to be hoped that these discussions, even though they may seem slow and repetitious to some persons, will continue annually.

The activities of the Council on Dental Education during the past two years have been noted with considerable interest by your committee. It must be pointed out that the Council has not attempted to determine what emphasis the schools should give the various subjects in their curriculums. Rather, the Council has examined the schools in terms of how well the various institutions are accomplishing their self-proclaimed objectives. It is possible that this attitude has contributed to the school administrators' recently evident increased interest in determining what the objectives of the teaching of orthodontics should be.

As yet there has been no release of information from the Council regarding the status of the teaching of any specific subject in the curriculum. Consequently, your committee cannot bring to your attention any official pronouncement by the Council concerning the teaching of orthodontics. However, there seems little doubt that the Council activities have had and will continue to have a beneficial influence on the teaching of orthodontics.

There has been much talk concerning postwar educational problems, but as far as your committee is aware, no definite planning or action has occurred. The responsibility for advanced training courses which is anticipated at the war's end will probably be met by the universities to the best of their respective abilities.

Throughout this period of difficult and changing circumstances, your committee would urge the members of this Association to be earnestly cooperative, understanding, and sympathetic with the institutions and persons who are striving to provide educational opportunities in dentistry.

Respectfully submitted,

T. D. SPEIDEL, Chairman
H. J. NOYES
G. M. ANDERSON

Read before the American Association of Orthodontists, Chicago, Ill., April 25 to 27, 1944.

REPORT OF THE RESEARCH COMMITTEE

At the New Orleans meeting of the Association, the Research Committee was empowered to enlarge the scope of its activities by (1) conducing a Prize Essay Contest and (2) arranging a Research Section for the annual meeting.

According to these recommendations your committee laid out a plant of procedure which was as follows: A letter was written to the heads of all orthodontic departments in this country and Canada and to other departments which might have research work in progress that would be of interest to our membership. The letter described the new activity of the committee and requested cooperation in the form of short reports of all research being prosecuted for the next annual meeting. This letter was sent out on July 10, 1942.

At the same time a notice was sent to various dental and orthodontic journals asking that they publish notes relative to the Research Section and also the Prize Essay Contest.

The response to our first letter was fairly good, many schools expressing enthusiasm for the new project and promising to let us know if they could contribute to the program. In addition to this, five manuscripts were submitted for the Prize Essay Contest.

When we were informed that the 1943 meeting was to be indefinitely postponed, we discontinued our efforts in regard to the Research Section and withdrew the monthly notices from the journals. But a decision had to be reached in regard to the disposition of the manuscripts that were already in our hands. It was the unanimous opinion of the committee that it would not be fair either to withhold the papers from publication or to penalize the contestants because the meeting was postponed. The papers were accordingly returned to their authors with permission for publication and they were informed that either the original paper or a reprint thereof would be called for at the time of judging. At the same time, the dead line for the submitting of new manuscripts was advanced one year. Thus, the rules of the present contest are different from those originally laid down in that they permit a three-year period of grace following training and the consideration of papers already published.

When notice was received that a meeting would be held in the spring of 1944, the orthodontic departments were once asked for contributions to the Research Section. This time a dead line was drawn and the response was more definite. In all, seventeen separate reports were promised and a fifteen-minute time limit was put on each contributor. Abstracts of not more than 250 words were requested, but only seven of these have been received to date. All arrangements have been made to hold the section meeting simultaneously with the general clinics.

The Prize Essay Contest was conducted as follows:

Shortly after the dead line was passed, the papers were sent to Dr. Hellman in New York. He gave each to an authority in the field covered by the paper, for the purpose of having it judged as a significant contribution. All of the papers were then turned over to a committee of three men, representing the fields of anatomy, histology, and orthodontics, for the purpose of ranking them. The results were as follows:

First Place,

"Studies on the Rate and Amount of Eruption of Certain Human Teeth," Harry Carlson, Sacramento, California.

Second Place,

"A Quantitative Method for the Comparison of Craniofacial Patterns in Different Individuals: Its Application to a Study of Parents and Offspring," Wendell L. Wylie, San Francisco, California.

Read before the American Association of Orthodontists, Chicago, Ill., April 25 to 27, 1944.

Third Place,

"Certain Aspects of the Growth Pattern of the Rabbit's Skull as Revealed by Alizarine and Metallic Implants," Philip Levine, D. C., U. S. Army, Newark, New Jersey.

In closing this report, the committee wishes to point out that, although the number of essays and research reports submitted was small, the quality of some of them was high. It also calls attention to the fact that these results have been gained in the face of wartime conditions which have placed marked restrictions on all academic and research efforts in fields not directly concerned with the war effort.

For these reasons the committee respectfully urges that the innovations introduced this year be continued, and that a budget be provided that will permit a prize of $200 to be awarded for the essay contest, together with travelling expenses for the successful competitor.

Respectfully submitted,

ALLAN G. BRODIE, Chairman, 1945
MILO HELLMAN, 1944
B. HOLLY BROADBENT, 1946

REPORT OF THE INTER-AMERICAN ORTHODONTIC CONGRESS

LIEUT. COL. CLAUDE R. WOOD

To the Membership of the American Association of Orthodontists:

Two years have elapsed since the consummation of the First Inter-American Orthodontic Congress, which was held in conjunction with the Forty-First (1942) Annual Meeting of the American Association of Orthodontists.

I would like to preface this Biannual Report by giving a short résumé of the status of the Inter-American Orthodontic Congress. The meeting which was held in New Orleans was officially designated as the First Inter-American Orthodontic Congress. During the time of this meeting, an official meeting of the delegates representing twenty of the twenty-one American republics was held, at which time officers of the Congress were elected as follows:

President, Claude R. Wood
Secretary-Treasurer, John W. Ross
Executive Committee: Representing the United States:
Claude R. Wood
John W. Ross
Brig. Gen. L. C. Fairbank
Representing the Dominion of Canada:
Vernon Fisk
Representing the West Indies:
Sergio Giquel
Representing Mexico:
Samuel Fastlicht
Representing Central America:
Alfredo A. Morales
Representing South America:
Armando Monti
Ricardo Salazar
Oscar Aldecoa

One delegate from each of the republics was elected as honorary president. The officers were instructed to continue the work of the Congress, which included the publication of the proceedings in Spanish.

The elected President, who was not present at the time of the election of officers, declined to accept the office of president, stating he considered that he had served during the First Congress and that the office should go to some representative of another country, but his protests were of no avail. He accepted the office with the stipulation that he would continue until such time as another Congress could be planned and a successor named.

The membership of this Association, I am sure, is aware of the scientific and social activities which took place during the annual meeting. On the adjournment of the sessions held in New Orleans, the entire group of twenty-two delegates proceeded to Walter Reed General Hospital, Army Medical Center, Washington, D. C. There they remained for one week of instruction in various phases of dentistry. The report of this week of instruction and the many social courtesies extended our guests have been recorded in print in various dental publications and I do not believe they need to be elaborated on at the present time.

Following this week in Washington, D. C., the Kellogg Foundation of Ann Arbor, Michigan, extended an invitation to the delegation to be the guests of the Foundation for the purpose of scientific study. Eleven of the delegates accepted and remained from two weeks to a few months. It is needless to comment on the various phases of instruction the delegates received from this outstanding institution. Every dental journal in Central and South America has commented most highly on the work carried on by the Kellogg Foundation. This study at the Kellogg Foundation was a fitting climax to the widest assemblage of Inter-American dentists that had ever gathered from the twenty republics of the Americas. The invitation to these delegates was a tribute to the American Association of Orthodontists.

It implied full confidence in our Association in selecting men for this Congress. The reports from the various departments and the Director of the Foundation justifies this confidence, as all comments were of the highest type, both as to the individual himself and as to his scientific standing. It is gratifying to learn that another group of Central and South American dentists have been in attendance at this institution. We are very proud that our group was the first to attend these courses which the Foundation contemplates for our neighbors to the South. We are pleased to learn that many of our delegates were on the selecting committee for those chosen for the second course recently concluded.

Another distinction which our society can be proud to claim is the fact that our organization was the first dental organization to receive the active support of our Department of State. While our primary purpose in initiating the Congress was to further the study of the science of orthodontics, we accomplished much, I am sure, in promoting the spirit of Inter-American cooperation. Since the meeting, we have received through our Department of State reports from some of our embassies in these countries, giving very complimentary accounts of the activities of our recent delegates. They have returned to their respective countries and have been most high in their reports not only of the Congress, but of the friendly spirit shown by the individual citizens of the United States. One of our delegates was in demand for public speaking not only in his own city, the Capital, but throughout his entire country. I feel we have maintained the trust that our Government placed in our hands.

I feel that we accomplished the primary purpose that motivated our thoughts in the formation of the Congress, because the formation of orthodontic societies and study clubs for the promotion of orthodontics among the countries represented has been most gratifying.

An annual report from each country was requested. The purpose of these reports was to maintain contact between the various delegates. This was accomplished by sending to each a mimeographed copy in Spanish of all reports received. This work was aided greatly by Dr. Fastlicht, without whose splendid cooperation it would have been impossible to accomplish. We, also, were very anxious to know the progress which had been made in the various countries in furthering the study of orthodontics. I am sorry we cannot report a full response, but the difficulties encountered in both the delegates' receiving the request and our receiving the report have been extremely high.

Numerous and comprehensive reports were received from many confreres in Latin-American countries, however, but on account of the lack of space, only the names of those who reported will be given here. In several of these reports were included news pertaining to orthodontic societies which had been formed in various countries.

On June 12, 1933, the Argentina Society of Orthodontists was formed with Dr. Jose Dueuas, as President and Professor, Dr. Juan Ubaldo Carrea, as Honorary President. In 1936 this society created *Ortodoncia* as its official publication.

A similiar society was then formed in Chile, called the Sociedad de Ortodoncia de Chile. The first board of directors of this society are as follows: President, Dr. Alejandro Manhood; Vice-President, Dr. Arturo Toriello; Secretary, Dr. Rafael Huneeus; Treasurer, Dr. Pedro Gandulfo.

In Honduras, has been organized La Associacion Hondureua de Ortodoncistas, that convenes once a month for the study of orthodontics.

There has also been organized, in Lima, Peru, on Jan. 14, 1943, the Peruvian Society of Orthodontics, with Dr. Agusto Taiman, Professor of Orthodontics, as President.

Reports were received from the following: Dr. Armando Monti, President of the Argentina Society of Orthodontists; Dr. David M. Cohen, Secretary of the Federation Odontological, Latin America; Dr. Vernon Fisk of Canada; Dr. Alejandro Manhood, President of the Orthodontic Society of Chile; Dr. De La Carrera of Chile; Dr. Roberto Chartier, President of the Costa Rican Dental Society; Dr. J. Benjamin Zlavaleta, President of Sociedad Dental del Salvador; Dr. Alfredo A. Morales of Guatemala; Dr. Jules Thebaud, director general of The National Public Health Service of Haiti; Dr. Alberto F. Smith, President of the dental and orthodontic society of Honduras; Dr. Samuel Fastlicht, President of the Orthodontic Society of Mexico; Dr. Fernando Jose Fueutes, Nicaragua; Dr. Ricardo Salazar of Peru.

Dr. John Ross, the Secretary-Treasurer of the Congress, will give a brief report on the history and on finances of the congress which, I am sure you will agree with me, are in excellent condition.

Editorial

A Recent Poll on Medical Care

In a recent poll conducted by a group of nationwide civic and business organizations directed by businessmen, the attitude taken on the medical-care angle of the social security setup is interesting and revealing to the health professions.

Policy statements on the basis of a preliminary count add up to something like this: public action to provide protection against nonindustrial and occupational sickness should not be taken until a reasonable time has expired to allow the private effort of employers to supply such security.

The poll revealed that there is majority approval given to the statement that employers should provide for their employees some protection against sickness; also, that in the event such protection should be given by public action, it should be done at state and local levels of government rather than at the federal level.

Majority gave approval to the statement that voluntary group plans should be allowed to operate as auxiliary to government plans, and that voluntary group effort to provide more adequate medical service for all of the people should be urged.

The majority said that there should be avoidance of a system of socialized medicine under which all of the medical personnel would become government employees and the free choice of doctor by patient and of patient by doctor would be impaired.

The above poll of opinion is important because it comes from a cross section of business people rather than from political or other biased sources.

The Wagner bill as now written passes dentistry with a gesture and leaves it to the Surgeon General and the Social Security Board for study and legislation, to be called for two years subsequent to the passing of the Wagner bill. The Health Insurance Plan of Greater New York also ignores dentistry, though on its roster of incorporators it includes representative leaders in many other fields. Dr. Ray Lyman Wilbur, in the *Journal of the American Medical Association*, says that it is inevitable that more and more subsidiary help will be needed to conserve the time of carefully trained physicians, including nurses and all kinds of technical assistants. This observation is interesting because it inferentially leaves dentistry in the same speculative position as does the Wagner bill; therefore, it looks as though the time had arrived for plans to be made from within the profession and its subdivisions.

In the presidential address of James A. Burrill before the American Association of Orthodontists in Chicago, attention was called to the fact that accord-

ing to the bylaws of the association the economic problem now on the horizon is a specific problem of the Public Relations Committee. This committee was accordingly instructed to work with the corresponding committee of the American Dental Association and report at the next meeting of the American Association of Orthodontists.

On account of things shaping ahead, the report of the Public Relations Committee in Colorado Springs in 1945 will be looked forward to with unprecedented interest and anxiety.

H. C. P.

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There may be members in the Service whose names do not appear in the above list. These members should notify the secretary at once so that their names may be included.

Max E. Ernst, Secretary, American Association of Orthodontists, 1250 Lowry Medical Arts Bldg., St. Paul, Minn.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

The Principles and Practice of Industrial Medicine: Edited by Fred J. Wampler, M.D., Professor, Private and Industrial Medicine, Medical College of Virginia; and contributors. Pp. 579. Price $6.00. Baltimore, Williams & Wilkins Company.

Industrial medicine has long been a distinct specialty of medical practice. Even during the Middle Ages it was well known that certain occupations left their mark on the health of the worker. Industry, even before the days of social legislation, found it economical to pay attention to the health of the worker, especially if considerable expense was involved in training him.

It is surprising to find that, while the nurse has been included in this volume, no mention is made of the dentist. Among the subjects treated are the effects of temperature and humidity on industrial workers, fatigue, a survey of substances which cause occupational poisoning, industrial lead exposure, and lead poisoning. Here mention is made of the "lead line." The statement is included that "Obvious deposits of lead sulphide are seen in the gums of persons with no demonstrable symptoms or signs of intoxication, but the development and extension of a lead line may be accepted as a notation of progressive lead absorption."

Among the contributors are many accepted specialists in industrial medicine, which gives this book authoritative standing.

Contact Dermatitis Resulting From the Manufacture of Synthetic Resins and Methods of Control: By Stephen D. Lockey, B.S., M.D., F.A.C.A., Lancaster, Pa., *J. Allergy* **15**: 188-195, May, 1944.

The principal synthetic resins manufactured in the United States are:

1. Phenol-formaldehyde resins sold under various trade names, such as Bakelite, Durite, Durez, Resinox, Indur, and Catalin.

2. Urea-formaldehyde resins, sold under trade names, such as Beetle and Plaskon.

3. Coumarone resin made from coal tar residue.

4. Ester gums which are natural resins, such as rosin, dammar, copal, in which the acid of the resin has been combined with glycerol.

5. The glyptal resins, which are a combination of glycerol and an organic acid, such as, phthalic and malleic acids.

6. The vinyl resins, which are vinyl esters, ethers, or halides combined with phenol, formaldehyde, and hexamethylenetetramine.

7. Furfural resins obtained from combining furfural with phenol and formaldehyde. (Furfural is obtained from corn cobs by treating with H_2SO_4 and by fractional distillation.) Also there are those made from soy beans and corn kernels.

8. Chlorinated resins obtained by chlorinating various oils and balsams.

Over 2,600 various objects used in this country in addition to dental objects are made of resins. The most important of these, from the standpoint of volume manufacture and skin hazards involved, are the phenol-formaldehyde and the urea-formaldehyde resin.

PREVENTIVE MEASURES FOR THE PROTECTION OF WORKERS AGAINST SKIN HAZARDS FROM SYNTHETIC RESINS AND WAXES

Each employee should have a complete physical examination.

1. In order to show that a dermatitis is caused by occupational substances, it must be established: (1) that the dermatitis followed contact with the resin, (2) that the portion of the skin which came in contact with the resin was first affected, and (3) that hypersensitivity to the resins is or was present as shown by the fact that a powdered portion of the suspected substance placed on the clear skin near the eruption in the form of a patch test gives a positive reaction if left on from twenty-four to ninety-six hours.

To determine the actual chemical in the resin which caused the dermatitis, the nature and chemical composition of the resin must be determined, and patch tests performed on the patient with each of the chemicals composing it.

The patches of the chemical should be in such dilutions that will not cause reaction on the normal skin if left on for twenty-four hours. A 2 per cent solution of phenol can remain on the normal skin in the form of a patch test for twenty-four hours without causing a reaction. A 4 per cent solution of formaldehyde can remain on the normal skin in the form of a patch test for twenty-four hours without causing a reaction. Powdered coumarone resin may remain on the normal skin in the form of a patch test for twenty-four hours without causing a reaction.

2. The allergic background of each employee should be very carefully investigated. If his ancestors were allergic he should not be employed in this department. New applicants for jobs should have a complete physical examination and be carefully scrutinized for skin diseases, and those found to have them should not be employed. About 43 per cent of employees who claim compensation for contact dermatitis have their claims disproved. Trichophytosis, eczema, and other skin lesions are often found. It is, therefore, equally important to disprove as well as prove a case of contact dermatitis. There should be periodic medical examinations of workers to detect cases of dermatitis.

3. Clean working clothes with long sleeves or long-sleeved overalls fastened at neck and wrists should be provided. The clothes should be cleaned daily and should not constrict the worker in any manner, as dermatitis often develops at the site of constriction.

4. Facilities should be furnished to each worker so that he can change from his street clothes to his working clothes. The lockers for street clothes and work clothes should be in separate rooms with the shower baths between the locker rooms. The worker coming in to work enters the locker room used for the street clothes, takes them off and puts them in the locker, and goes into the locker room where his clean work clothes are kept and dons them. From this room he goes to the workroom through a connecting door. At the end of his shift he goes through this door to the work clothes locker room, takes off his work clothes, and leaves them there to be washed, and then goes to the street clothes locker room puts on his street clothes, and goes out of the door leading to the street. It has been estimated at one plant where such a system was instituted that 9 cents a day per worker will take care of furnishing clean work clothes each day. Employees should never be allowed to wear their working clothes home, as this extends the time of exposure.

Where synthetic waxes are used or made, eating should be prohibited in the workrooms. Suitable eating places should be provided and the workers compelled to wash the hands and clean under the nails before eating.

5. The workrooms themselves should be ventilated by intake exhaust fans to remove dust and fumes. The floors, walls, ceilings, and machines should be washed down or vacuum-cleaned at frequent intervals to keep them fresh and free from dust and wax.

Dispensers containing 70 per cent alcohol can be set up in the manufacturing area. Alcohol neutralizes phenol and formaldehyde when present on the skin. During warm months frequent washing of the forearms acts as a preventive measure.

6. Workers, who have abrasions or skin breaks, should be treated immediately, as dermatitis often starts at the site of an abrasion.

Supplement to the Dental Treatment of Maxillo-Facial Injuries: By W. Kelsey Fry, M.C., M.R.C.S., L.R.C.P., L.D.S., R.C.S.(Eng.), Consulting Dental Surgeon to the Royal Air Force, Consulting Dental Surgeon to the Ministry of Health, Dental Surgeon to Guy's Hospital; P. Rae Shepherd, L.D.S., R.C.S.(Eng.), Dental Surgeon, East Grinstead Maxillo-Facial Unit, Alan C. McLeod, D.D.S. (Penn.), B.Sc. (Dent.), Toronto, L.D.S., R.C.S. (Eng.), Dental Surgeon East Grinstead Maxillo-Facial Unit; and Gilbert J. Parfitt, M.R.C.S., L.R.C.P., L.D.S., R.C.S.(Eng.), Dental Surgeon, East Grinstead Maxillo-Facial Unit; with section on Fractures of the Middle Third of the Face by A. N. McIndoe, M.S., R.R.C.S., consulting plastic surgeon, Royal Air Force, Surgeon-in-charge, East Grinstead Maxillo-Facial Unit, Philadelphia, J. B. Lippincott Co., 1944.

This edition is for readers who seek to know more of the method of application of the principles, procedures, and apparatus discussed in the parent book, *The Dental Treatment of Maxillo-Facial Injuries*. The present edition makes constant reference to the parent book, and in writing the case histories it has been assumed that the reader is well acquainted with the parent book.

A wealth of illustrations has been provided, many in colors. The part dealing with "Radiology" presents photographs of roentgenograms and outlines

of the position of the patient in each case. Photographs of pathologic sections have been included in the chapter on "Pathology."

The method of construction and application of various dental splints is presented in a clear and succinct manner. Numerous case reports are discussed and illustrated in full detail. Every conceivable oral condition is taken into consideration in discussing the dental management of fractures. Extra-oral splinting is described. The armamentaria employed are discussed in detail and the method of application of splints is shown in numerous photographs. This book continues the high standard of excellence set by the parent book.

The dentist and the oral surgeon, whether in civilian or military practice, will find here a valuable, practical manual.

Sugar Research Foundation Grants in Dentistry

Research grants to six colleges and universities have been announced by Dr. Robert C. Hockett, Scientific Director, Sugar Research Foundation. The Foundation is providing support to research relating to sugar in nutrition, biochemistry, physiology, medicine, dentistry, metallurgy, microbiology and fermentations, organic chemistry, and by-product utilization. Others may be added to the list.

The following grants in aid have been announced:

Professor Ancel Keys, Laboratory of Physiological Hygiene, University of Minnesota, $36,000, for research on thiamin and other vitamins and the relationship of a high sugar diet to fatigue.

Professor Julian A. Boyd, Department of Pediatrics, University Hospital, Iowa State University, Iowa City, $21.500. Doctor Boyd feels that the sugar content of the diet is without effect on the teeth if all the other essential factors are provided. Experimentation would involve a foreperiod of six months without dietary controls but with the full routine of dental, bacteriological, and physical examinations. Then a controlled diet period of one year, and, finally, a postcontrol period of six months would follow.

Professor F. J. Stare, School of Medicine and Public Health, Harvard University, and Dean A. Leroy Johnson, School of Dental Medicine, Harvard University, $25,000, for research.

Proposed Investigation.—The reasoning of the Scientific Director has been that, on the subject of dental caries, two closely coordinated studies should be made, one with human subjects and one with animals. Animal experiments are never conclusive alone because of possible differences between any other animal and man. On the other hand, human experiment has limitations. It is possible to feed children diets which are expected to *prevent* caries but never to attempt to *produce* caries. The project will use rhesus monkeys as subjects and will attempt to evaluate all the factors which cause or prevent caries with special attention to the role, or possible role, of sugar.

Other grants made were to Professor Melville L. Wolfrom, Department of Chemistry, Ohio State University, Columbus, $24,000, and Professor Carl Neuberg, Department of Chemistry, Washington Square College, New York.

News and Notes

Discovery of Anesthesia by Horace Wells

One hundred years ago next December there occurred in Hartford, Connecticut, an event of really epoch-making importance. This was the discovery, by a young Hartford dentist, of the anesthetic properties of nitrous oxide. Others before him, especially Sir Humphrey Davy and Crawford Long, had come close to telling the world of medicine and dentistry that pain need no longer be present when operations are performed. Davy had hinted at it; Long had actually used ether to deaden pain, but neither had reached out to other dentists or doctors to proclaim to them the blessings of anesthesia during operations.

Until nearly the middle of the nineteenth century, extraction of teeth or surgical operations of even more painful nature had been accomplished without any of the pain-killing drugs now in use. People were bound to chairs or tables, or held by several attendants, as parts of their anatomy were cut, hacked, or sawed away. Today when we hear of the many and diverse operations being done for the health and well-being of mankind, we are inclined to take for granted the blessings of anesthesia for the deadening of the pain that formerly was ever present. Not so long ago many people died from malignant growths rather than submit to the pain of extraction. We must keep all this in mind to appreciate the full significance of the discovery by Horace Wells, the Hartford dentist.

Wells had had as good an education for dentistry as was possible at the time. There were no dental colleges and he had studied under some dentists in Boston, where he had then opened an office for a short time; very soon, however, he established himself in Hartford.

He was still a young man, only 21, when he came to Hartford to practice, but he soon became one of the leading dentists of that section. Other young men, two of whom later became famous, William Morton and John M. Riggs, became, in turn, his pupils.

Wells always had an inquiring mind and an inventive skill. Along with this was a desire to excel, to help people, and to be well thought of by them. He invented, designed, and made some of his equipment; he wrote a treatise containing many modern concepts on the care of the teeth.

He was concerned that people seemingly had to suffer so during operations. He gave much thought to ways in which such suffering might be averted, and he talked with people about it. Consequently, he had the training, the background, the attitude, and the interest needed to understand the situation which eventually arose and gave him the clue he needed for his discovery.

On Dec. 10, 1844, there was an entertainment in Hartford given by a traveling lecturer, Samuel Colton. The basis of the entertainment was a demonstration of the peculiar effects nitrous oxide had on different people when inhaled in small quantities. Laughing gas, it was called, but it didn't make everyone laugh; some became belligerent or adopted other attitudes. At the entertainment one of the participants became injured quite severely while under the influence of the gas. He sat down near Wells after the effect of the gas had worn off, only then becoming aware of his injury.

This was not a circumstance Wells could have foreseen, but he had the questioning mind that immediately focused upon the cause and effect relationship involved. His conclusion was that a person under the effect of nitrous oxide felt little or no pain as a result of the gas. Sir Isaac Newton, we are told, lay under an apple tree and watched an apple drop. From little things like these which most people would pass by, great discoveries are sometimes made.

Wells may or may not have been certain of his conclusion, but he meant to experiment further to be sure; and he decided to experiment on himself. The next day he obtained a large supply of nitrous oxide from Colton, the lecturer, and secured the assistance of his

friend Riggs, the dentist whom he had taught and who now had an office near his own. In the presence of Colton, Riggs, and one or two others, he inhaled a larger supply of the gas than was customary. Then, after Wells became insensible, Dr. Riggs extracted one of his teeth.

As soon as Wells had recovered from the nitrous oxide inhalation, he knew that his earlier conclusion was correct. Here, at last, was a means that would do away with the pain people had suffered without his discovery. From that day on, both Wells and Riggs and any other who so desired made use of nitrous oxide in deadening pain. Wells did not keep his knowledge to himself; he proclaimed to others the news of his great find. Anesthesia for surgical operations had been discovered!

Early in 1845 Wells went to Boston to explain to others there what he had tried out and found successful several times. He sought out his old friend, Morton, who had moved there earlier and was established in practice. Morton saw at once that Wells' discovery was epoch making. And an arrangement was made whereby Wells could demonstrate his method before a group of Boston students.

That time, unfortunately, things did not move smoothly, and Wells was jeered by the students in true iconoclastic student manner. Wells was a shy and sensitive man and was deeply hurt. He returned to Hartford without making further attempt in Boston to prove the worth of his discovery. But the fire had already been lighted there. Morton and other had been stimulated to go on with experimentation. Wells was the pathfinder; others would go on farther after he showed the way. It has always been that way with discoveries and discoverers. It has to be that way. But we should not forget to honor the person whose mind first solved the basic problem. His genius must not be forgotten.

Wells returned to Hartford and took up dentistry again and engaged in other occupations as well. His active mind carried him on from one thing to another. He made a trip to Paris and while there explained his discovery.

As the months went by and others seemed to be receiving credit for what was his discovery, he became somewhat disappointed and discouraged. He died in 1848 at the age of 33.

Honors began to come to Wells right after his death and have been piling up ever since. Resolutions had been made by medical and dental societies in England, France, and Spain, honoring Wells for his discovery. Other memorials in the form of bust, statue, plaque, memorial window, memorial carved pew end, etc., have been made. Resolutions have been passed by medical and dental societies and by state legislatures. His name and fame have become established.

This year, 1944, the centenary year, the American Dental Association plans to commemorate again Wells' discovery. Besides the main meeting in Hartford on December 11, there will be meetings of state associations to honor his discovery. Articles will appear in professional and trade journals and in the newspapers. Speeches will be made to tell again the story of Wells' discovery. It is the essence of immortality that the influence of a man goes on and on for better or worse. Everyone today who has been helped by any kind of surgical operation owes a debt of gratitude to Horace Wells, the young Hartford dentist.

The American Dental Association will sponsor the centenary program through a national committee headed by Dr. Eugene M. Clifford of Hartford, and comprised of the following: Drs. L. Pierce Anthony, Chicago, W. Harry Archer, Pittsburgh, Don J. Aubertine, San Francisco, Fred T. Murless, Jr., Hartford, B. Lucien Brun, Baltimore, Paul H. Jeserich, Ann Arbor, Mich., W. E. Mendel, Pittsburgh, Water R. McFall, Asheville, N. C., Robert L. Sprau, Louisville, Ky., W. J. Gies, New York, T. E. Way, Cincinnati, Arthur H. Merritt, New York, Howard R. Raper, Albuquerque, N. M., W. N. Hodgkin, Warrenton, Va., and Oren A. Oliver, Nashville, Tenn.

Physical Fitness Program

The great victories which are being won by American troops in war zones all over the world are not being won by men who are physical weaklings or degenerate types of manhood. In this, as in previous wars, the American soldier has proved himself to be about as competent a fighter as the world can produce. He represents a selection of the best physical specimens that the nation has developed; to them have been applied the techniques for physical and military training that the years have proved to be efficient. In selecting the men who now constitute our Armed Forces, 33,000 doctors and 10,000 dentists participated as members of various boards.

In 1943 President Roosevelt created a National Committee on Physical Fitness under the egis of the Federal Security Agency with Mr. John B. Kelly as chairman and Colonel Rowntree as vice-chairman. At the invitation of this Committee, the Board of Trustees of the American Medical Association with the support of the House of Delegates has authorized participation of the Association on a joint committee with the National Committee on Physical Fitness, to be charged with developing and operating a program for improving physical fitness throughout the nation during the year, beginning September 1. Such a program would include evaluation of the physical state of our young men and women and increase the activities and responsibilities of schools and colleges in physical education, also improve opportunities for gaining physical health and enlist the active support of industrial, social, religious, patriotic, professional and other groups.

War Service Committee, American Dental Association

The War Service Committee, on Aug. 26, 1944, began distribution of a comprehensive questionnaire to all members of the dental profession in the Armed Forces of the United States, whether in the continental United States or overseas.

The respective chiefs of the dental services in the Army, Navy, Public Health Service, and Veterans Administration are cooperating wholeheartedly in the distribution of the questionnaires and the Committee expresses appreciation on behalf of the Association to these officials for their efforts in this regard.

It is felt that the returns from this questionnaire will indicate quite clearly the interest of the American Dental Association in its members and others in the dental profession, and will result in the securing of valuable data on which to base recommendations for the post-war era. Several points stand out predominantly, namely, the opportunity for the men to express themselves on the vital subject of refresher courses, the expression of their desire to teach, location of future practice, and ways the American Dental Association may be helpful.

When the information has been properly assembled and compiled, it will then be made available to other interested committees of the Association and to such state societies and others who may request it.

Fluorine Experiment of Newburgh, N. Y.

Dental history is in the making as the attention of the nation is centered on two New York communities which are engaged in a mass demonstration to test the theory that a minute amount of fluorine in drinking water is the way to banish tooth decay.

Kingston, N. Y., will be the town with toothaches. Newburgh, also on the Hudson River, will be the lucky one without if the experiment is a successful one.

The battle against dental caries in the New York towns has been given nationwide publicity and the August 13 issue of *Science Service*, weekly science page syndicated to hundreds of newspapers, devoted a five column feature to a detailed report of the experiment.

Fluorine, chemical sister of the chlorine that many communities put into their drinking water to purify it, has been in dental headlines on many occasions. As more and more evidence began piling up to show that a small amount of fluorine in the drinking water protected teeth from decay, many thought something should be done about it.

The New York State Department of Health decided it would do something about it. So, under the direction of Dr. David B. Ast, it is staging a long-range demonstration which may prove conclusively the practicability of mass protection against tooth decay by the simple measure of adding a little fluorine to public drinking water.

Newburgh, a town of 30,000 population, already has some 0.12 parts per million of fluorine in its water. To the three million gallons of water the city uses daily will be added about 45 pounds of fluoride salt. This will bring one part per million of fluorine in the water as it flows from every tap and faucet in Newburgh.

Newburgh's 5- to 12-year-old children for the next ten years will have their teeth examined every year in the schools by the associate research dentist of the State Health Department. Since fluorine acts on the tooth structure during the years of tooth development, it will be about ten years before the full benefit of the water treatment will be realized.

The control group in this mass experiment to test whether tooth decay can be banished by adding fluorine to drinking water also will be children in Kingston.

Says Science Service:

"Every proper scientific experiment of this sort, whether on human or laboratory guinea pigs, must have its control or check run. A group as much alike as possible is selected. One-half gets the new treatment, the other does not. Every other condition is kept as nearly identical as possible. In that way, with the treatment the only variable factor, scientists can feel sure that if any difference appears in the treated group, it was due to the treatment and not to other variable factors."

Prize Essay Contest

The Research Committee of the American Association of Orthodontists is empowered by the Board of Directors to conduct a prize essay contest. The prize has been set at

$200.00 and will be offered annually until further notice. The terms of the competition are as follows:

***Eligibility.*—Any student enrolled in a recognized university, or any person who has completed his or her formal education in orthodontics not more than two years prior to Jan. 1, 1945, is eligible to compete for the prize.**

***Essay.*—The essay must represent a piece of original research having a direct bearing on the field of orthodontics. It may relate either to a biological or clinical problem and may represent material that has been offered in partial fulfillment of the requirements of a graduate or postgraduate degree, or any graduate, postgraduate or undergraduate contest. No papers previously submitted for publication or in press will be accepted. All essays must be in the hands of the committee not later than two months prior to the annual meeting of the Association. Consult periodic literature for this date. If no essay is deemed worthy by the committee, the prize will be withheld.**

***Award.*—The prize-winning essay will be accorded a place on the scientific program of the annual meeting of the Association, at which time the prize will be awarded. The Association will retain publication rights of the first three choices.**

For further information, address

ALLAN G. BRODIE, Chairman. Research Committee, A.A.O., 30 North Michigan Ave., Chicago 2, Ill.

American Association of Orthodontists

The next meeting of the American Association of Orthodontists will be held at the Broadmoor Hotel, Colorado Springs, Colorado, May 21 to 24, 1945. Members of the American Dental Association are invited to attend this meeting. Proper credentials should be obtained in advance from the Secretary of the American Association of Orthodontists or from the secretary of a constituent society.

MAX E. ERNST, Secretary, American Association of Orthodontists, 1250 Lowry Medical Arts Building, St. Paul, Minn.

Enormous Human Teeth Recently Discovered

Gigantic fossilized human teeth six times as big as modern man's and twice as big as a gorilla's have recently been discovered, reports *Science News Letter,* by Dr. R. Von Koenigswald in a Chinese apothecary's shop.

Dr. Franz Weidenreich of the American Museum of Natural History, after careful examination, is convinced they are human, despite their great size, and suggests naming them "Gigantanthropus" or giant man. Dr. Weidenreich suggests that the original human beings may have been big, massive-boned creatures: "The occurrence of large fossil human skulls with very thick individual bones in early or later stages, for instance in Homo soloensis, Homo rhodesiensis and in the Heidelberg jaw, seems to indicate that gigantism and massiveness may have been a general or at least a widespread character of early mankind."

Hints of the former existence of outsize ancient men were first discovered in Java. The Javanese giants, in the opinion of Dr. Weidenreich, may have been of "the size, stoutness and strength of a big male gorilla." Further search for more complete remains of these giants must await the expulsion of the Japs from both China and Java.

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*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

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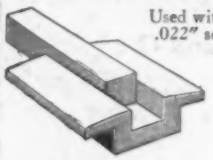
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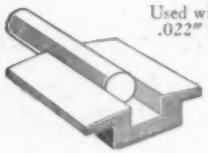
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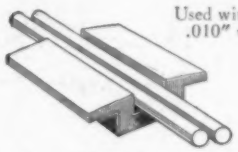
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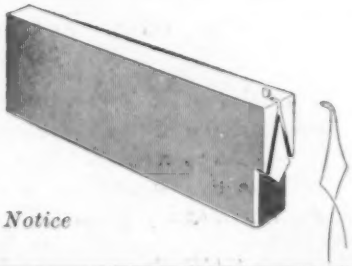
For preforming ligature wire .007″ to .010″ for use with Brackets M 464, M 465, and the Edgewise Arch Bracket.

$1.00 each



Prices Subject to Change Without Notice

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